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GEOTHERMAL ENERGY DEVELOPMENT IN NEVADA'S GREAT BASIN

HEARING

BEFORE THE

SUBCOMMITTEE ON
ENERGY AND MINERAL RESOURCES

OF THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

NINETY-EIGHTH CONGRESS

SECOND SESSION

TO EXAMINE THE CURRENT STATUS AND FUTURE NEEDS OF NEVADA'S GEOTHERMAL ENERGY INDUSTRY

SPARKS, NV, APRIL 17, 1984

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GEOTHERMAL ENERGY DEVELOPMENT IN NEVADA'S GREAT BASIN

TUESDAY, APRIL 17, 1984

U.S. Senate,
Subcommittee on Energy and Mineral Resources,
Committee on Energy and Natural Resources,
Sparks, Nev.

The subcommittee met, pursuant to notice, at 9:05 a.m., in the Sparks City Council Chambers, Sparks, Nev., Hon. Chic Hecht, presiding.

Present: Senator Hecht.

Also present: Robert L. Terrell, professional staff member; and Craig Gannett, counsel for the minority.

OPENING STATEMENT OF HON. CHIC HECHT, A U.S. SENATOR FROM THE STATE OF NEVADA

Senator Hecht. Good morning, everyone, I am Chic Hecht, U.S. Senator from Nevada, and I will be calling this hearing together.

Today I will be chairing this hearing of the Senate Subcommittee on Energy and Mineral Resources to examine the currrent status and future needs of Nevada's geothermal energy industry.

At the outset, I want to thank everyone here for taking the time out of their busy schedules to let the U.S. Senate know what is going on out here in the real world. Goodness knows, we need your advice.

The State of Nevada is blessed with some of the largest geothermal reserves in the world, suitable for both electric power production and space heating applications through the use of technologies relatively new in the United States. Like any other new technology, it takes time, money, and a certain amount of Government cooperative to put Nevada's geothermal energy reserves to productive use.

Energy development is a risky business. We are now experiencing a so-called energy glut, and energy prices have been stable for several years. Electric utilities in Nevada and many parts of the West have plenty of power on hand to serve customers well into the 1990's. This makes it tough to develop and market a new product, like hot water geothermal energy, whose short-term cost may be higher than energy produced through other conventional means.

But as we have learned twice in the last decade, the price of oil and other fossil fuels can skyrocket overnight. Our Nation is still importing roughly 40 percent of its daily oil consumption, and at the risk of sounding melodramatic, the situation in the Middle East is very shaky right now. It is a powder keg waiting to explode.

For this reason, we have to prepare for the inevitability of another oil supply disruption. We have to insulate ourselves from this event by assisting the development of new domestic technologies.

This is where the Government comes into the picture. In the case of geothermal energy, the Federal Government is involved at every step in the process, from geothermal leasing, to tax credits, to environmental controls, to the regulation of electricity sales. And with such a young and fragile industry, we have to make sure that these programs are actually encouraging rather than retarding programs.

Today we will be hearing from a variety of witnesses, each of whose expertise and support is essential to the development of geothermal energy in Nevada. I encourage each witness to try and limit his oral remarks to 10 minutes, if at all possible, so that we will have plenty of time for questioning.

Finally, before proceeding with our first witness, I would like to briefly introduce the staff members who put this hearing together. Dan Freihofer is my legislative assistant for energy and natural resources, responsible for covering my day-to-day work as a committee member.

I am also fortunate to have John Laszlo on my staff, who is on a 1-year congressional fellowship sponsored by the American Society of Mechanical Engineers. He is on leave from the Pacific Gas and Electric Co., where for many years he was closely involved with the development of geothermal powerplants at the geysers.

Bob Terrell, Graig Gannett, and Betty Nevitt are from the professional staff of the Senate Energy Committee.

Those who would like a copy of the printed record for today's hearing should print your name and address on the signup sheet located in the back of the room.

I want to notify our witnesses today that the subcommittee may be submitting written questions to each of you following the hearing. The record for this hearing will remain open for witnesses to respond to written questions and for others to submit statements who are unable to be here today. This record will close in 3 weeks.

Finally, I want to include written statements by Senator Laxalt and Congresswoman Vucanovich at this point in the record. Extra copies of these statements are available on the press table for anyone who is interested.

[The statements of Senator Laxalt and Congresswoman Vucanovich follow:]

Statement of Senator
Paul Laxalt
Subcommittee on Energy and Mineral Resources
Senate Committee on Energy and Natural Resources
April 17, 1984

Mr. Chairman:

I appreciate this opportunity to submit for the record my views on developing the geothermal resources of our nation and on the work of this Subcommittee.

The Committee is to be commended for exercising its oversight responsibility to gauge the speed of that effort and highlight those problems which may be hampering the process. Geothermal power has the potential to provide a significant portion of our power needs in the future. The abundance of fossil fuels now available to us will become more costly to extract and transport in the years ahead. It is, therefore, prudent that the nation proceed in a systematic and orderly manner to the discovery of our geothermal fields and to the development of the technology which will be required to harness the heat of the earth. The most immediately available such resource is that provided by steam and hot water, the hydrothermal element.

The Geothermal Steam Act of 1970 established leasing arrangements and set acreage and time limitations on private industry activities. Those provisions appear to have created resistance to, rather than encourage development of, our geothermal resources. The 20,480 acre per state limitation, for instance, has hampered those companies and individuals most willing to devote the time and resources necessary to geothermal development. The question of when to require competetive bidding, always difficult to set, is particularly acute in the case of geothermal. It may prove appropriate to lengthen the present 10 year limit in which a geothermal resource must be broght into production.

The Congress has also provided several tax incentives for geothermal development. These are the Renewable Energy Investment Tax Credit and the Residential Renewable Energy Credit. Extension of these incentives is being considered as part of the Deficit Reduction Package now being considered on the Senate floor. Hopefully the Subcommittee will develop additional insights into tax and other federal incentives to private industry. If given the right incentives, there is no doubt in my mind that private capital will be available and commited to this promising energy resource.

I have a particular interest in geothermal development, Mr. Chairman, because, as you know, Nevada contains geothermal resources of enormous potential. Surface manifestations abound throughout the State of the near accessability of earth heat. These resources have been used for years for providing heat and individual use of the resource is increasing. Unfortunately for power development uses, the Nevada resource is not generally of the hot steam type that can be directly applied to power generation. Such "clean" resources are rare, occuring only in the Geysers area of California, within the United States. However, as the technological barriers to using hydrothermal resources of lower heat, higher mineralization, and high liquid water content are resolved, the vast potential of those vast resource fields can be brought into production.

It is imperative that this nation encourage this process of development. Hydrothermal resource are renewable as are our hydropower energy. They promise long term and low cost power.

I wish the Subcommittee every success in its endeavors.

Thank you.

BARBARA F. VUCANOVICH
2ND DISTRICT, NEVADA

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STATEMENT OF
BARBARA F. VUCANOVICH, M.C.
ON GEOTHERMAL ENERGY DEVELOPMENT IN NEVADA'S GREAT BASIN

BEFORE THE SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

APRIL 17, 1984

Mr. Chairman, distinguished members of the Subcommittee:
I appreciate the opportunity to present my testimony to you today as you begin your hearing on the status of geothermal energy development in Nevada. I am pleased that the Subcommittee has recognized the potential of geothermal energy development in Nevada by choosing to hold this field hearing in our State.

One of my long standing concerns is our Nation's dependence on foreign resources to meet our domestic energy needs. A few numbers illustrate the reason for my concern:
- the United State relies on fossil fuels to supply about 90 percent of our energy needs;
- we as a country are about one-third dependent on imports;
- three-quarters of our known oil and gas reserves will be gone by the year 2000.

In our efforts to achieve energy independence from unstable foreign suppliers and to assure future energy supplies, I believe we should not overlook the potential energy supply that can be provided by our domestic geothermal resources.

The U.S. Geological Survey estimates that as much as 3.4 million acres, most of which are federal or public lands located in the western one-third of the country (including Alaska and Hawaii), are geologically favorable for geothermal development. As far as Nevada is concerned, I recently received a very large and detailed map from the University of Nevada showing the locations of more than 900 geothermal springs and wells throughout the state. The map also describes significant developments and the history of selected geothermal resource areas. As just one example, in Caliente (located about 180 miles northeast of Las Vegas for you non-Nevadans) a well drilled under a U.S. Department of Energy Appropriate Technology Grant is used to heat the Agua Caliente Trailer Park. Additional DOE grant funds are being used to explore the feasibility of heating the entire city with their geothermal resource. All in all, from a resource availability standpoint, the prospects for further geothermal development in Nevada and the Nation look promising.

For several years now Congress has recognized the potential of geothermal energy through the passage of legislation to:

- provide for the issuance of geothermal leases on the public lands;
- provide for research, development, and demonstration of geothermal energy technology; and
- to provide tax credits for various types of geothermal energy utilization.

However, the present laws and the rules that implement them do not always function in a way that encourages, or even makes feasible, the utilization of geothermal energy. Consider, for example, a case that was recently brought to my attention by Thomas Flynn who I understand is to testify here later today. In a letter to me he described how the Internal Revenue Service's ruling to define a geothermal resource as one having a minimun temperature of 50 degrees celsius (122 degrees farenheit) is limiting the ability of deserving users of geothermal energy to receive a residential tax credit. He cited the example of one Nevadan who heats his entire house with geothermal energy and was denied a tax credit because his well had a temperature of 121 degrees farenheit.

Certainly, this example shows that there are impediments to the widespread use of geothermal energy. Combine this with problems in the leasing system, marketing questions, and the financial viability of demonstration projects, and what you have is a valuable resource that is not being fully utilized. I am hopeful that this hearing will help to clarify and highlight the various changes that are needed before geothermal energy development will occur on a widespread basis. I am also optimistic that the information presented here today will justify the assumption that geothermal resources can offer an attractive, economic, environmentally sound, and secure alternative to imported fossil fuels.

Again, I appreciate the opportunity to contribute to this very important and timely hearing. Thank you very much, Mr. Chairman.

Senator HECHT. And now, without further adieu, I would like to introduce a very close friend of mine who served in the State Senate with me, and to all of you who have come from neighboring States, I want you to know in Nevada even though we have elected officials of different parties, we all work very, very, closely together. Now it is my pleasure to introduce to you the Honorable Richard Bryan, the Governor of Nevada.

STATEMENT OF HON. RICHARD H. BRYAN, GOVERNOR, STATE OF NEVADA

Governor BRYAN. Mr. Chairman, as we have referred to each other over the years, Chic, it is a pleasure for me to be here, and I would compliment you and your staff for making this appearance here in Sparks. I think you are gratified as I am by the size of the turnout. I think that is a tribute to you personally and your fine staff in assembling the program that we are going to have today.

Let me preface my remarks by saying that historically, we in the United States enjoyed energy self-sufficiency. If we needed more food, we grew it; if we needed more raw materials, we mined or pumped for it; if we needed more machinery, we built it; and if we needed new technology, we invented it.

As a Nation we have learned, painfully, that we are not energy independent. Yet, Nevada, unlike many States, has been blessed with an abundance of natural resources. We have both a wide variety and abundance of mineral resources.

Unfortunately, these resources have not been fully developed. We in Nevada currently import 95 percent of our energy needs, and consequently, export a great deal of our State's revenues to acquire those energy needs.

The majority of Nevada's existing powerplants are dependent upon out-of-State coal, gas, or oil to operate. We have the resources, in my judgment, to develop a high degree of self-sufficiency, and in the years ahead, we must begin to develop and utilize our State's natural energy resources, among them geothermal resources.

Geothermal energy in Nevada has an enormous potential. As former U.S. Senator Alan Bible once called it, a sleeping giant. Not only is geothermal widespread throughout the State, but it's quality is sufficient to support multiple uses, including residential space heating, aquaculture, and various manufacturing and industrial processes. In several areas, it is sufficient to generate large quantities of electrical power.

Geothermal areas are evidenced by hot springs along fractures stemming from major faults which bound the State's mountain ranges. Throughout the State there are more than 300 thermal springs, wells, and spring clusters, and it has been stated that the quantity and quality of the Nevada geothermal resources are among the highest in the Nation.

Fortunately for us, many Nevadans have already recognized the potential for geothermal development, and many are already successfully using this alternate energy resource today. The food processing plant at Brady Hot Springs has used the natural heat of the Earth for many years. The Peppermill Hotel and Casino and many residents in the southwestern part of Reno presently use geothermal for both water and space heating. The Elko Heat Co., is supplying geothermal heat through a variety of establishments in that city. And Mr. Wallace, a resident of Caliente, has used the resource to heat his trailers for a number of years.

As you are well aware, Nevada is one of the fastest growing States in the Nation. Accompanying this growth is an ever-increasing demand for energy. We all recognize the potential for geothermal in this State.

To facilitate geothermal development, the 62d session of the Nevada Legislature, which concluded just a year ago, passed and I signed into law an important new piece of legislation, assembly bill 335, creating the Nevada Department of Minerals. This, I might add, and you will recall, Senator, is the first time in the history of our State that minerals has been elevated to a department status.

You will recall during our tenure in the legislature together it was a division within the Department of Natural Resources and Energy, and I believe that you will agree with me that its elevation to this prominence is consistent with the objectives of your own committee. The chairman of this new department has just recently been appointed, Mr. Rich Reyburn, and he is here with us this morning, and I believe that you have him scheduled among your list of witnesses and he can explain for you and the staff the function of the department and how it is functioning with the commission, which serves as its policymaking body.

The agency is governed by a commission and is responsible for the wise use and management of our State's mineral resources, including geothermal.

Many of the regulatory responsibilities for geothermal development have been transferred to this department, while others rest with the State Public Service Commission, and I note that Fred Schmidt, one of the public service commissioners, is also scheduled to make a presentation to you this morning, the State engineer, and Roland Westergard's department also has responsibility, as does the Office of Consumer Services, headed by Linda Ryan. I can assure you that these agencies are and will continue to work together in guiding the development of geothermal resources for us in Nevada.

As you know, I have been working with you and the congressional delegation in terms of broadening our economic base, diversifying not only in terms of our tourism but agriculture, aquaculture, and industrial development in Nevada.

It is my judgment that a development of geothermal energy resources can play a major role in our efforts to diversify Nevada's economy. Indeed, geothermal activity itself is a burgeoning industry. Last year 15 permits relating to geothermal exploration were issued. That compares dramatically with the proceeding year in which none were issued.

Eight major companies, including Phillips and Chevron, have begun exploration activity in the State.

My staff and I and other State agencies stand ready to assist both individual and large geothermal interests in the wise development and efficient utilization of our State's geothermal resources. It is estimated that Nevada's geothermal power generation could equal several thousand megawatts, which is more than double the existing energy requirements in northern Nevada at the present time.

So, to conclude, it is my assessment that it's time for us in Nevada to awaken the sleeping giant and to harness nature's cleanest and most environmentally acceptable energy resource.

Mr. Chairman, I thank you for the opportunity to be here, and I will be looking forward to the report which you and your staff assemble, and I might just say on a personal note that we at the State level enjoy working with you, and we will pledge our continued support, not only in terms of the activities of this committee but your other endeavors on behalf of the State. Thank you.

Senator HECHT. Thank you, Governor, and I enjoyed your testimony. I enjoyed your words, and I think that different individuals who have come long distances and taken time off from their busy schedules to appear here today will take note that the executive branch and congressional branch of Nevada politics work together. Thank you very much.

Governor BRYAN. Thank you very much, Senator.

Senator HECHT. Would the first panel please take their seats. Our first witness, Mr. Richard Reyburn, executive director of the Nevada Department of Minerals.

Mr. Reyburn, you have already had an introduction from the Governor. So, we are waiting to hear from you.

STATEMENT OF RICHARD REYBURN, DIRECTOR, NEVADA DEPARTMENT OF MINERALS

Mr. REYBURN. Thank you, Senator Hecht. Senator Hecht, members of the staff, my name is Richard Reyburn. I am director of the Department of Minerals for the State of Nevada.

And the Nevada Legislature in its 62d session demonstrated a very strong support for the mining industry and created the Department of Minerals. Along with this legislation was created the Commission on Mineral Resources. This provides the industry with a very strong voice in State government.

Some of the authority that was vested in the department is to regulate and promote the development of Nevada's mineral resources, which includes mining, oil, and gas, and the subject of today's hearing, geothermal.

Our department is funded entirely by the minerals industry, and it is our primary goal to provide for the welfare of all of the people of Nevada through the responsible development and management of our State's abundant mineral resources.

The commission and the department recognize the importance of developing and utilizing alternative energy resources and the tremendous potential that is involved with geothermal resources.

With the passage of assembly bill 335, many of the responsibilities for geothermal development were transferred to our department. The governing body of our department, the Commission on Mineral Resources, is currently in the final process of formulating new geothermal regulations necessary for carrying out the provisions as specified in 534A of the Nevada Revised Statutes.

In October 1983, Commission Chairman Fred Gibson appointed a geothermal subcommittee to develop a draft of the regulations. The subcommittee is made up of Commissioners Peter Hummel, Ross de Lipkau, and Peter Galli.

They in turn formed a technical working committee composed of industry representatives in order to facilitate the development of the regulations and provide industry input. The technical committee consisted of: Bob Forrest with Phillips Petroleum, Ed Western of Sun Geothermal, Joyce Emerson of AMAX Exploration, Bob Geddry with Monterey Energy, Bob Wright representing the Western Oil and Gas Association, and Bob Warren of the Nevada Mining Association.

This committee spent an extensive period of time formulating the original draft of the new regulations. Individual members were assigned specific topics and developed each of these sections, presented them back, to the working committee, and they put them in an order for the approved format that was reviewed by Mr. Hummel and members of my staff.

Once the original draft was completed, each member of the committee was asked to carefully review the document and recommend necessary changes. It was also sent to the State engineer's office for his review and comment, and to the legal staff of the Legislative Counsel Bureau for possible wording changes and legal suggestions.

When we received the comments and recommendations back from all of these parties, they were incorporated into a final draft which should be available to the public sometime the end of this week. Following a time for public comment, we will hold hearings where the public can make any comments that they need to, and then, it will be presented to the full Commission on Mineral Resources for adoption.

Our department will play a very important role in the development of Nevada's geothermal resources. Our regulatory responsibility along with our promotional responsibility will require continual interfacing with various Federal and State agencies. We feel that we have developed the type of rapport that will assist us in dealing with people from the industry, the various agencies involved and provide a cooperative working realtionship for the overall benefit for the State of Nevada.

Because of the importance of the geothermal industry in Nevada's economy, our staff will keep the Governor's Office, members of the legislature, and Nevada's congressional delegation informed of new developments in the State. We will also work very closely with our State legislature to minimize restrictive requirements and eliminate unnecessary laws.

As a closing statement, I would like to reiterate the Governor's comment that we all recognize the tremendous potential for geothermal in the State and that now is the time to act in order to develop this great resource. Nevada's geothermal industry has the potential to make significant contributions to the economic vitality of our State for many years to come.

Our department is prepared and anxious to assist in any way we can the individual and commercial users of geothrmal and also those that are interested in developing this resource for power generation. Thank you.

Senator HECHT. Thank you very much, Mr. Reyburn.

We will go on and have the entire first panel. Then we will come back for questioning.

Our next witness, Mr. Fred Schmidt, commissioner, Nevada Public Service Commission.

STATEMENT OF FREDERICK J. SCHMIDT, COMMISSIONER, PUBLIC SERVICE COMMISSION OF NEVADA

Mr. Schmidt. Thank you, Senator, and I want to thank the Senate for bringing the committee here to Nevada, pull together the resources in this State to hold this important forum.

The comments that I'd like to make in my summary are briefer than the statement I submitted, and for the benefit of those present, additional copies have been brought. I have attached a copy of the commission's regulation on avoided costs, which I think it most interesting to the committee.

The comments I want to give in my summary at this time, though, will focus merely on the commission's regulation of geothermal, which I would summarize in four areas, and then some observations that I'd like to make on obstacles and incentives to the development of electricity in Nevada.

Senator Hecht. Thank you. Your full testimony will be in the record.

Mr. Schmidt. Thank you very much.

The four ares of the commission's regulation where legislation granting authority of the commission which impact geothermal energy can briefly be summarized as follows:

The first area would be the commission's regulation that directs sales of geothermal energy to the public under a statute that was passed in July 1981 by the Nevada Legislature. Since 1981, the commission has processed four applications under this statute, primarily for steam heat.

Those are by Nevada Geothermal Utility Co., Hydrothermal Energy Corp., Elko Heat Co., and Sierra Geothermal. Those four applications have been processed expeditiously. Two have already been granted, probably the most significant of which is Elko Heat Co., now serving portions of the city of Elko and several casinos.

The second area of the commission's regulation which impacts geothermal development is the State's Utility and Environmental Protection Act, better known as UEPA, that under which the commission acts as the lead agency for granting construction permits to build new generating electric plants in Nevada. No electric generation plants fueled by a geothermal resource are operational in Nevada today. To date only one application has been filed for a construction permit for an electric generation plant. That application was just recently filed in February with the commission for a 650-kilowatt facility just north of Wabuska, Nev., in Lyon County.

The construction permit regulation of the commission also extends to transmission lines, an area which I want to address in more detail later. Any transmission facilities or substation designed to operate larger than 200 kilovolts in Nevada also requires a construction permit from the commission.

A third area, just granted to the commission in 1983, by the Nevada Legislature, and perhaps the most important for future geothermal resource in Nevada from the commission's perspective, is the Resource Planning Act. Under that act the two major utilities in Nevada must submit plans detailing their sources of supply for the next 2, 10, and 20 years, beginning July 1 of this summer. The commission must then determine the adequacy of those plans, including specific determinations of the sources of supply.

We do not intend to take this task lightly. Evidence of that is best illustrated by our recently adopted general order 43, the regulation implementing this new statute.

The Resource Planning Act establishes a major new role for the commission in determining the amount and timing of geothermal development for electricity in Nevada. The commission will either approve or disapprove of future electricity to be purchased and/or developed by Nevada's two major utilities from geothermal resources for the first time then later this summer and every 2 years thereafter.

Finally, and perhaps most important area of interest, at least to developers and perhaps to the committee, is the commission's authority granted to it by Federal statute, the Public Utility Regulatory Policies Act of 1978. Under this act the Federal Congress granted commission authority to regulate the rate of sales and purchases of electricity between qualifying facilities and electric utilities. The commission adopted regulations quickly after that statute was passed. Those regulations are now 3 years old. They contain what is known as the commission's rule on avoided costs.

Currently approved rates for both Sierra Pacific and Nevada Power Co. are updated every 3 months pursuant to that regulation. The current rate in way of passing for Sierra Pacific are only 5 cents, and for Nevada Power, there is a rate of 8.4 cents for on-peak energy and 2.2 cents for off-peak energy. There is also an associated capacity allowance.

Interestingly enough, those rates are developed under the same rule which indicates the flexibility of a rule that the commission implemented. When the commission implemented the rule it stated it was its intent to take an active role in the promotion of cogeneration and small power production in Nevada. That intent applies today as it did then. Although, I find it interesting to note that no developers or other parties have petitioned the commission during the 3 years that the rule has been in effect to change the avoided-cost rule.

On the other hand, the rule has not yet really been utilized by utilities in Nevada or developers until recently. Sierra Pacific petitioned the commission barely over 1 month ago for a declaratory order to approve perhaps the first three contracts in the State of Nevada between a utility and various geothermal producers within the State.

Those contracts are with the Phillips Petroleum, Geothermal Development Associates, and a consortium of National Energy Associates and Sequoia Thermal Corp., which combined could produce a total of 24 megawatts of capacity within the State of Nevada to be added to Sierra Pacific's system.

Each of those contracts has a unique formula for computing the rate of sale pursuant to the commission's allowance in its avoided cost regulation that utilities may contract on a basis other than pure avoided cost.

The Attorney General's Office of Advocate for Customers of Public Utilities has requested a hearing on that petition, and just last week I scheduled a hearing on those contracts for early May.

Those four areas summarize the commission's regulation of geothermal in the State of Nevada, and now I'd like to briefly make some observations about what obstacles and incentives are in the State of Nevada. PURPA and various Federal tax incentives for renewable resource development have stimulated growing interest in this resource. State regulation, I believe, has complemented that initiative.

The best example of that attitude of which I am aware of is the commission's aggressive attitude toward resource planning and the implementation of an avoided-cost rule. There is room for additional improvement. State agencies need to work together to avoid unnecessary overlapping regulation and time delays while still continuing to protect the public interest.

Several obstacles, though, still prevent rapid development in Nevada. The economic feasibility of Nevada's geothermal resource is still marginal when compared to alternative generation. However, the major gap which once existed has narrowed. Ever-increasing fuel, construction and operating costs at the more traditional, electric-generating facilities have made renewable resources, such as geothermal, more attractive.

Is there an adequate and accessible market to stimulate meaningful development? Nevada's population in growing rapidly. Yet, price increases and conservation efforts have slowed a parallel increase in electricity consumption. Geothermal potential in Nevada is probably many times greater than the total capacity of Sierra Pacific's current system.

Larger markets also experiencing rapid growth in southern Nevada and California remain largely inaccessible to transmission line contraints. There is no current Nevada transmission interconnection between the major electricity markets in northern and southern Nevada.

An interconnection may be made if the White Pine Power project is built later this decade. However, there is no assurance that such additional transmission capability will benefit geothermal developers. A more direct northwest-southwest intertie within Nevada is needed.

Larger markets in California are also currently inaccessible to the geothermal resource in Nevada. Transmission connections between Sierra Pacific and Pacific Gas & Electric over the Sierras is now only two 120-kilovolt lines and a single 60-kilovolt line. Those lines are currently fully loaded, primarily with hydroelectricity which PG&E and others receive from northern California.

The transmission constraints which were recently felt by Nevadans when the State sought again to obtain Central Valley project hydropower marketed by Western Area Power Administration of the Federal Government in northern California. There is also no current transmission capability existing between northern Nevada and Sierra Pacific on the one hand and large southern California markets on the other.

It appears that only a combination of either geothermal developers, a joint effort by Sierra Pacific and California Electric Utilities, or the Federal Government, perhaps even an aggressive new role for the Sacramento office of Western, can come up with the financial resources needed to construct major transmission connections with California markets. But before that direction is pursued, an important question needs to be answered. To what extent should Nevada's natural resources be exported to California?

Clearly some portion of this important renewable resource will eventually serve Nevada's electric utility customers. This commission is committed to that end. But how much, how soon and at what costs still remain unknowns.

The soon-to-be-filed, Nevada electric utility resource plans and the pending Sierra Pacific petition for commission approval of the first three electric generation contracts from geothermal resources in Nevada may provide some early answers.

Thank you very much, Senator.

[The prepared statement of Mr. Schmidt follows:]

STATEMENT ON GEOTHERMAL DEVELOPMENT IN NEVADA

Submitted By

Frederick J. Schmidt

Commissioner, Public Service Commission of Nevada

I. Introduction

Nevada's Department of Minerals and Office of Community Services and previously the State's Department of Energy have undertaken substantial effort to locate and quantify Nevada's geothermal resource. A substantial resource has been identified and quantified and can best be explained in detail by those offices and potential developers. Given that a significant, basically untapped natural resource exists in Nevada, these comments will focus on Public Service Commission of Nevada ("Commission") regulation of geothermal energy and then on obstacles and incentives to future development of electricity from those resources.

The Commission was created by act of the Nevada Legislature in the early 1900's to regulate utilities operating in the State of Nevada. Today the Commission oversees some or all of Nevada operations of telephone, electric, gas, water, motor carrier, cable television and other utilities pursuant to Chapters 703 through 712 of the Nevada Revised Statutes ("NRS"). Four areas of Commission regulation impact geothermal development in Nevada.

A. Operating Permits (NRS 704.669)

Direct sales to the public of geothermal energy are regulated by the Commission under NRS 704.669. Since July 1981, this statute has required geothermal developers to obtain an operating permit from the Commission in order to sell geothermal energy directly to the public. The Commission must generally determine an applicant's fitness, determine the capability of the resource and system to provide for the intended use, set a rate or formula for rates and continually monitor an operating permit to ensure that adequate service is provided.

On December 16, 1982, the Commission adopted regulations implementing this authority. Those regulations may be found in the Nevada Administrative Code ("NAC") at sections 704.760-704.784. A copy of the regulations is attached in the appendix to this statement.

An operating permit is not required of entities which intend to sell their geothermal product for resale. Therefore, developers who generate electricity from a geothermal source for sale to a utility are not affected by this regulation. Only utilities directly serving the public are required to obtain an operating permit pursuant to NRS 704.669. The most common application would be the development and retail sale of geothermal energy for space heating.

Since 1981 the Commission has processed four applications for operating permits. The four applications and a brief summary of their status are listed below:

1. Docket No. 82-360 Nevada Geothermal Utility Company, Inc.

Filed July 1, 1982 to serve an area at the west end of Moana Lane in Southwest Reno. The original application proposed service to 60 homes in Warren Estates Subdivision but approval was only granted for 10 homes until operating data were available for analysis. A Compliance Order was issued March 11, 1983 requiring a discharge permit from the Nevada Department of Environmental Protection ("NDEP"). The NDEP permit was issued August 30, 1983. Order and Geothermal Permit GOP #001 was issued by the Commission on August 31, 1983.

2. Docket No. 82-702 Hydrothermal Energy Corporation

Filed December 23, 1982 to serve almost all of southwest Reno. March 17, 1983, the Commission issued a Compliance Order limiting the service area to approximately 40 acres at the intersection of Plumas and Moana in southwest Reno and further limited hookups to only the Salem Plaza condominiums. It also required issuance of the discharge permit from NDEP. On March 15, 1984, the Commission granted an extension of time for filing of the permit from NDEP to September 17, 1984. The NDEP permit has not been issued nor has a GOP from the Commission been issued.

3. Docket No. 83-806 Elko Heat Company

Filed August 3, 1983 to serve the entire City of Elko. The applicant agreed to limit service to the capacity of this existing well and file annual reports with Commission Staff, so on October 20, 1983, GOP #003 was issued by the Commission. A discharge permit was not required from NDEP because the effluent was held in an open pond and did not endanger existing water resources.

4. Docket No. 83-1035 Sierra Geothermal, Inc.

Filed October 21, 1983 to serve an area in southwest Reno at the intersection of Moana Lane and Dant Boulevard next to the service area of Nevada Geothermal Utility Company, Inc. On January 1, 1984, the Commission issued a Compliance Order allowing the applicant to serve the approximately 30 units applied for but required issuance of the discharge permit by NDEP before the operating permit would be issued. To date the NDEP permit has not been issued.

B. Construction Permits (NRS 704.820-704.900)

In 1971, the Nevada Legislature designated the Commission as the lead agency for implementation of the Utility Environmental Protection Act ("UEPA"), found at NRS 704.820-704.900. Under this act public utilities in Nevada which intend to develop geothermal resources into electricity must obtain a construction permit from the Commission prior to building an electric generating plant in Nevada. The permit is not required for facilities "over which an agency of the Federal Government has exclusive jurisdiction." NRS 704.865(3)(c). A permit is also not required where the electrical energy generated is wholly consumed on the premises by the producer. NRS 704.855(2). Less clear is the applicability of the construction permit requirement to developers who propose to generate and sell electricity to entities for resale. See NRS 704.030(6) and 704.855. Commission attorneys have argued that the construction permit is required for such facilities.

No electric generation plants fueled by a geothermal resource are operational in Nevada today. To date only one application has been filed for a construction permit for an electric generation plant. That application was filed with the Commission February 10, 1984 by TAD's Enterprises, Inc. and has been assigned Docket No. 84-222. The application requests a construction permit for a 650 kilowatt ("Kw") plant just north of Wabuska, Nevada, in Lyon County. Commission Staff is currently reviewing the application.

In addition to requiring a construction permit for electric generating plants, the UEPA also requires construction permits for electric transmission lines and substations designed to operate at 200 kilovolts ("Kv") or more. Because most of Nevada's geothermal resource is located some distance from existing transmission lines, a construction permit(s) pursuant to the UEPA will probably be necessary in the future for meaningful development of electric generation.

Later I will discuss some of the transmission constraints impeding development of electric generation from geothermal resources in Nevada. It is interesting to note that there are no pending construction permit requests under the UEPA on file with the Commission.

C. Resource Plans for Major Nevada Electric Utilities - NRS 704.736-704.751 and General Order 43

The Commission has been given substantial new authority relative to the resource plans of Nevada's major certificated electric utilities. The 1983 Nevada Legislature passed what is affectionately known as the Resource Planning Act. NRS 704.736-704.751. The Act applies to Sierra Pacific Power Company ("Sierra Pacific") and Nevada Power Company ("Nevada Power").

Beginning July 1, 1984, both of these electric utilities must file a resource plan detailing sources of supply for the next 2, 10 and 20 years. The Commission then must determine the adequacy of the plan including a specific determination of the sources of supply. This new task will not be taken lightly. Evidence of that is best illustrated by General Order 43, the Commission's voluminous regulations adopted March 5, 1984 to implement the statutes.

The Resource Planning Act establishes a major new role for the Commission in determining the amount and timing of geothermal development in Nevada. The Commission will either approve or disapprove the amount of future electricity to be purchased or developed by Nevada's two major electric utilities from geothermal resources for the first time this summer and every 2 years thereafter.

D. Rates Paid to Qualified Facilities by Nevada Utilities

The Public Utility Regulatory Policies Act of 1978 ("PURPA") limited the authority of state regulatory agencies to regulate "qualifying small power producers" as defined in Section 201. A geothermal electric generation facility under 80 megawatts ("Mw") will generally be a qualifying facility under PURPA. The Commission is without jurisdiction to regulate the rates, financial structure or organizational structure of such qualifying facilities.

While PURPA limited the Commission's usual broad authority it made the Commission a critical agency for geothermal development. PURPA accomplished this by allowing for Commission regulation of the rate for sales and purchases of electricity between qualifying facilities and electric utilities. Federal regulations adopted by the Federal Energy Regulatory Commission to implement these important aspects of PURPA are contained at 18 C.F.R. §292. After several hearings in Docket No. 2357, Sub 4, the Commission adopted its own regulations of such sales pursuant to the authority delegated by PURPA. General Order 32 now codified at NAC 704.690-704.745 was adopted February 17, 1981. A copy of the regulations is attached as an appendix to this statement.

In explaining the regulations the Commission stated in an accompanying Opinion that it "intends to take an active role in the promotion of cogeneration and small power production in Nevada." The rules sought to do just that. Electric utilities were ordered to file tariffs setting forth current price offerings for the purchase of power from small power producers based on the utilities' fully avoided cost. An update is required every 3 months of each utility's avoided cost.

The currently-approved rate for sales to Sierra Pacific is 5.1¢ per kilowatt hour ("Kwh"). The rate includes payment for energy and capacity. Nevada Power's currently-approved rate provides for separate on-peak (10:00 A.M. - 10:00 P.M., June 1 through September 30) and off-peak (all other hours) rates. On-peak rates are 8.4¢ per Kwh for energy and $9.73 per Kw for capacity. Off-peak rates are 2.2¢ and $0.13. Approved methods for calculating the avoided cost are explained in the February 17, 1981 Opinion.

While avoided cost is the critical guideline, Nevada utilities are also given the option to negotiate contracts with qualifying facilities. Interconnection costs are the responsibility of the qualifying facility. Utilities must file a tariff permitting the amortization of interconnection costs through a reimbursement program. The regulations also address reporting requirements; system emergencies; design, operating and safety requirements; procedures for changing rates and a forum for resolving disputes. Interestingly, in over 3 years no one has requested the Commission reevaluate the methods initially adopted for determining avoided costs.

On the other hand, Sierra Pacific recently (February 24, 1984) petitioned the Commission for a declaratory order approving three contracts between Sierra Pacific and various geothermal developers. (Docket No. 84-250.) The three contracts are with:

1. Phillips Petroleum Company - 9 Mw facility at Desert Peak, Nevada, north of Fallon.
2. Geothermal Development Associates - 5 Mw facility at Steamboat Springs south of Reno.
3. National Energy Associates and Sequoia Thermal Corporation - 10 Mw facility in Smoky Valley, Central Nevada.

Each contract has a unique formula for computing the rate of sale. The Attorney General's Office of Advocate for Customers of Public Utilities has requested a hearing on the petition. I have recently scheduled a hearing on the petition for early May.

III. Obstacles and Incentives to the Development of Electricity from Geothermal Resources in Nevada

I believe there are several major obstacles to rapid development of electricity from geothermal resources in Nevada. On the other hand, there are important incentives that should be recognized. Before discussing the obstacles I'd like to briefly highlight the incentives.

The PURPA and various federal tax incentives for renewable resource development have stimulated growing interest in geothermal energy. State regulation has complemented that initiative. The best example of that attitude of which I am aware is this Commission's aggressive attitude toward resource planning and implementation of an avoided cost rule. There is room for additional improvement. State agencies need to work together to avoid unnecessary overlapping regulation and time delays while continuing to protect the public interest.

Several obstacles may still prevent rapid development. The economic feasibility of much of Nevada's geothermal resource is still marginal when compared to alternative generation. However, the major gap which once existed has narrowed. Ever increasing fuel, construction and operating costs at the more traditional electric generating facilities have made renewable resources, such as geothermal, more attractive.

Is there an adequate and accessible market available to stimulate meaningful development? Nevada's population is growing rapidly. Yet price increases and conservation efforts have slowed a parallel increase in electricity consumption. Geothermal potential in Nevada is probably many times greater than the total capacity of Sierra Pacific's current system.

Larger markets also experiencing rapid growth in southern Nevada and California remain largely inaccessible due to transmission line constraints. There is no current Nevada transmission interconnection between the major electricity markets in northern and southern Nevada. An interconnection may be made if the White Pine Power Project is built. However, there is no assurance that such additional transmission capability will benefit geothermal developers. A more direct northwest-southwest intertie within Nevada is needed.

Larger markets in California are also currently inaccessible. Transmission connections between Sierra Pacific and Pacific Gas and Electric ("PG&E") over the Sierras is now only two 120 Kv lines and a 60 Kv line.

Those lines are fully loaded with hydro electricity which PG&E and others receive from dams in Northern California and with economy energy sales from Valmy. The transmission constraints were recently felt by Nevadans when the State sought again to obtain Central Valley Project hydro-power marketed by Western Area Power Administration ("Western") in northern California. There is also no current transmission capability between Sierra Pacific and the large southern California market.

It appears that only a combination of geothermal developers, a joint effort by Sierra Pacific and California electric utilities or the federal government (perhaps an aggressive new role for the Sacramento region of Western) can come up with the financial resources needed to construct a major transmission connection with the California markets. But before that direction is pursued an important question needs to be answered. To what extent should Nevada's natural resources be exported to California?

Clearly some portion of this important renewable resource will eventually serve Nevada's electric utility customers. The Commission is committed to that end. How much, how soon and at what cost remain unknowns. The soon to be filed Nevada electric utility resource plans and the pending Sierra Pacific petition for Commission approval of three contracts may provide some early answers.

APPENDIX

Cogeneration and Small Power Production

704.690 Definitions.

As used in NAC 704.690 to 704.745, inclusive, unless the context otherwise requires:

1. "Avoided costs" means the incremental costs to a utility of electric energy or capacity, or both, which, but for a purchase from a qualifying facility, the utility would generate itself or purchase from another supplier.

2. "Facility for cogeneration" means a facility which combines the production of power and useful heat by the sequential use of a resource of energy whereby the rejected heat of one process becomes the energy input into a subsequent process.

3. "Small facility" means a facility which produces electric energy solely by the use of biomass, waste or renewable resources, or any combination thereof, as its primary source of energy and which has the capacity to produce not more than 80 megawatts of power.

4. "System emergency" means a condition on a utility's system which is likely to have the imminent result of:

(a) A significant disruption of service to customers; or

(b) An endangering of life or property.

[Pub. Service Comm'n, Gen. Order 32 § 2.0, eff. 8-21-81]

704.695 Scope.

The provisions of NAC 704.690 to 704.745, inclusive, apply to all public utilities supplying electric service.

[Pub. Service Comm'n, Gen. Order 32 § 1.2, eff. 8-21-81]

704.700 Adoption of federal regulations.

1. The provisions of 18 C.F.R. §§ 292.202 to 292.207, inclusive, are hereby adopted by reference, as those provisions exist on August 21, 1981.

2. A copy of those provisions may be obtained from the commission at its offices at 505 East King Street, Capitol Complex, Kinkead Building, Carson City, Nevada 89710 for the price of 10 cents per page.

[Pub. Service Comm'n, Gen. Order 32 § 3.3, eff. 8-21-81]

704.705 Criteria for small facilities, facilities for cogeneration.

1. A small facility is a qualifying facility if it meets the criteria for:

(a) Maximum size;

(b) Use of fuel; and

(c) Ownership,

as set forth by the Federal Energy Regulatory Commission in Title 18 of the Code of Federal Regulations in sections 292.202 to 292.207, inclusive.

2. A facility for cogeneration is a qualifying facility if it meets the:

(a) Criteria for ownership;

(b) Standard for operating; and

(c) Standards of efficiency,

as set forth by the Federal Energy Regulatory Commission in those sections of Title 18 set forth in subsection 1.

[Pub. Service Comm'n, Gen. Order 32 § 3.0, eff. 8-21-81]

704.710 Submission of information.

The owner or operator of a qualifying facility shall submit the following information to the commission:

1. His name and address and the location of the facility;

2. A brief description of the facility, including a statement whether it is a small facility or a facility for cogeneration;

3. The primary source of energy used or to be used by the facility;

4. The capacity of the facility for the production of power; and

5. The percentage of ownership which is held in the facility by any electric utility or any holding company of a public utility.

[Pub. Service Comm'n, Gen. Order 32 § 3.4, eff. 8-21-81]

704.715 Requirements for report of data.

1. The Sierra Pacific Power Company and the Nevada Power Company shall file with the commission:

(a) The estimated avoided cost on its electric system, solely with respect to the energy component, for the various levels of purchases from qualifying facilities. The levels of purchases must be stated in blocks of not more than 100 megawatts for systems with a peak demand of 1,000 megawatts or more and in blocks of not more than 10 percent of the peak demand of the system for systems having a peak demand of less than 1,000 megawatts. The avoided costs must be stated in cents per kilowatt-hour for early and seasonal peak and off-peak periods for each of the next 5 years.

(b) The electric utility's plan for the additions of capacity by amount and type, for purchases of firm energy and capacity and for capacity requirements for each year during the next 10 years.

(c) The estimated costs of capacity at the completion of the planned additions and planned firm purchases of capacity on the basis of dollars per kilowatt and the associated cost of each unit of energy, expressed in cents per kilowatt-hour. These costs must be expressed in terms of individual planned firm purchases.

This data must be revised by May 31, 1982, and at least every 2 years thereafter.

2. The Idaho Power Company shall file with the commission a copy of all data which it has placed on file with the Idaho Public Service Commission.

[Pub. Service Comm'n, Gen. Order 32 § 4.0, eff. 8-21-81]

704.720 Information required for design, operation, safety.

A utility shall file with the commission, in the format for a tariff, the requirements for design, operations and safety related to facilities for cogeneration and small facilities located within the utility's certificated area in this state.

[Pub. Service Comm'n, Gen. Order 32 § 5.0, eff. 8-21-81]

704.725 Costs of interconnection.

1. A qualifying facility must pay for all appropriate costs of interconnection with an electric utility.

2. The costs of interconnection of a facility which is already interconnected with a utility to sell electric energy are limited to any additional expenses incurred by the utility to permit purchases of electric energy.

3. The utility shall file with the commission, in the format for a tariff, a program of reimbursement which would provide for the amortization of the costs of interconnection.

[Pub. Service Comm'n, Gen. Order 32 § 6.0, eff. 8-21-81]

704.730 System emergency.

1. A qualifying facility is required to provide energy or capacity to an electric utility during a system emergency only to the extent:

(a) Provided by agreement between the facility and the utility; or

(b) Ordered by federal authority pursuant to the Federal Power Act (16 U.S.C. § 824a).

2. During any system emergency, an electric utility may discontinue:

(a) Purchasing electric energy from a qualifying facility if the purchases would aggravate the emergency; and

(b) Selling electric energy to a qualifying facility, if the discontinuance is nondiscriminatory.

3. An electric utility may make the final determination whether to buy electric energy from or sell electric energy to a qualifying facility during a system emergency.

[Pub. Service Comm'n, Gen. Order 32 § 7.0, eff. 8-21-81]

704.735 Rates for purchase of power.

1. An electric utility shall file with the commission, in the format of a tariff, a standard rate for its purchase of power from qualifying facilities whose capacity is less than 100 kilowatts. The rate must:

(a) Be just and reasonable to the customers of the utility and in the public interest;

(b) Not discriminate against qualifying facilities; and

(c) Reflect the full avoidable costs of the utility based upon a methodology approved by the commission.

2. An electric utility may enter into a contract for the purchase of power from a qualifying facility of any size. The utility shall file with the commission copies of any contract entered into with a qualifying facility.

3. The rates for sales to qualifying facilities must be identical to the rates applicable to customers within the same class of customers as the qualifying facility.

4. The rates for purchases made from qualifying facilities must be in accordance with subsection 1, whether or not the utility making the purchases is simultaneously making sales to the qualifying facility.

[Pub. Service Comm'n, Gen. Order 32 § 8.0, eff. 8-21-81]

704.740 Change of rates for purchase of power.

1. At least once every 3 months, the utility shall file a tariff, setting forth any changes in its rates, procedures or conditions for the purchase of power from qualifying facilities. The tariff filing must include a rate for energy, a rate for capacity and a statement of the procedure used to calculate avoided costs.

2. The commission will assign a docket number to the tariff and, if necessary, will schedule a hearing on the propriety of

the tariff once every 6 months. The commission may, at any open meeting, determine the propriety of the quarterly calculation of rates.

3. With the filing of the quarterly tariff, the utility shall include proof that notice of the filing has been served upon each qualifying facility from which it purchases power. The notice may be given by first class mail.

4. Written comments on the propriety of a tariff must be filed with the commission at least 15 days before the effective date of the tariff.

5. The commission may schedule a hearing once every 6 months to consider comments on the procedure used to calculate the rates set forth in the tariff and consider other matters relating to the rules governing cogeneration. The commission will, where practicable, schedule such a hearing to coincide with the utility's hearing on deferred energy costs. In the case of quarterly filings for which a hearing is not scheduled, the commission may convene an open meeting to consider written comments which were previously submitted and relate to the calculation of the rates.

[Pub. Service Comm'n, Gen. Order 32 § 9.0, eff. 8-21-81]

704.745 Resolution of disputes.

The commission may resolve disputes between a qualifying facility and a utility which are germane to the utility's compliance with NAC 704.690 to 704.745, inclusive.

[Pub. Service Comm'n, Gen. Order 32 § 10.0, eff. 8-21-81]

SUPPLIERS OF GEOTHERMAL ENERGY

704.760 Purpose.

The purpose of NAC 704.760 to 704.784, inclusive, is to establish a requirement and procedure for obtaining an operating permit for the sale of energy from geothermal resources to the public.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.762 Applicability.

NAC 704.760 to 704.784, inclusive, has the same applicability as NRS 704.669.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.764 Definitions.

As used in NAC 704.760 to 704.784, inclusive:

1. "Commission" means the public service commission of Nevada.

2. "Geothermal resource" has the meaning ascribed to it in NRS 534A.010.

3. "Person" has the meaning ascribed to it in NRS 704.015.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.766 Operating permit required.

Any person who intends to sell energy from geothermal resources to the public must obtain an operating permit from the commission before:

1. Commencing the construction of any facility for that purpose except a geothermal well; or

2. Engaging in the sale of geothermal energy.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.768 Application for operating permit.

A person who wishes to apply for an operating permit must submit his application to the commission. The application must contain:

1. A general description of the proposed system, including:

(a) The area to be served;

(b) The type of service to be provided; and

(c) The type of system that will be used.

2. A detailed description of:

(a) The proposed service area;

(b) The proposed operating system; and

(c) The geothermal resource.

3. A statement of the economic feasibility of the proposed system.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.770 Description of service area.

The detailed description of the area to be served must include:

1. A copy of the map which was submitted to the state engineer with any application for water rights.

2. A legal description of the area.

3. An explanation of how the geothermal energy will be used. This explanation must specify the uses which will be made of the geothermal energy, for example, heating of spaces, heating of water, heating in industrial processes and generation of electricity.

4. The number and type of customers whom the utility expects to be serving at the end of the 1st, 5th and 10th years of operation and their heating requirements expressed in British thermal units. The customers must be identified as residential, commercial, industrial or other.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.772 Description of operating system.

The detailed description of the proposed operating system must include:

1. An explanation of the type of system to be used, including:

(a) The number, size, depth and productive capacity of the wells and pumps;

(b) The amount, type and size of the pipelines for transmission and distribution;

(c) The type of system for heat exchange, together with supporting test data;

(d) The type of system for injection or water disposal system which will be incorporated into the system;

(e) The type of facility for water treatment, if any;

(f) The type of metering system, if any; and

(g) The type of backup or standby facilities, if any, which the applicant will provide or will require individual customers to provide.

2. A map in sufficient detail to show the location of the facilities for production, transmission and distribution, including the wells, pumps, pipelines, heat exchangers and other components, and their spacing from the service lines of other utilities. This map must be of the same size as the map submitted with the application for water rights.

3. A list of all other utilities whose underground systems may be affected by the proposed system, a description of the manner in which each of those systems may be affected, and an explanation of the safety measures which the applicant will take to ensure that those systems will not be adversely affected.

4. A statement showing:

(a) The base and peak loads which the geothermal system is capable of supplying; and

(b) The applicant's projections of the base and peak loads which will be supplied during the 1st, 5th and 10th years of operation,

with his supporting calculations based on pumping tests and test data on the efficiency of the heat exchangers in terms of British thermal units per hour of output under standard conditions.

5. A statement signed by a registered professional engineer or by an official having responsibility to enforce the local building code, that:

(a) The calculations of the load and design of the system have been reviewed;

(b) The calculations of the load appear reasonable; and

(c) The system is designed in compliance with the applicable codes and has sufficient capacity to meet the projected uses.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.774 Description of geothermal resource.

The detailed description of the geothermal resource must:

1. Be accompanied by a copy of the permit for appropriation, issued by the state water engineer, for each well which the applicant intends to utilize as a source of supply for the proposed system. If the applicant intends to purchase geothermal energy from another person, the applicant must include a copy of the agreement under which he will obtain that energy, together with evidence that the person from whom he will be obtaining the energy has perfected rights to the geothermal resources from which the energy will be drawn.

2. Contain the information needed to define the capacity of the resource, including:

(a) The results of a pumping test performed on each well, including:

(1) The flow rate;

(2) The recorded temperatures;

(3) The recorded drawdown;

(4) The date of each pumping test; and

(5) The duration of each pumping test.

(b) The results of a gross chemical analysis of a water sample taken from each well 15 minutes before the end of the pumping test.

3. Unless specifically waived by the commission, the application must be accompanied by a statement, signed by a professional geologist, hydrologist or engineer who has experience in evaluating geothermal resources, that:

(a) He has examined the results of the pumping tests and other relevant information; and

(b) The resource appears capable of supplying sufficient energy to meet the intended uses.

The statement must be accompanied by any technical and professional evaluations that were used in the expert's analysis, and an exhibit showing the qualifications of the expert who has signed the statement.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.776 Confidentiality of exploration and subsurface information.

If any exploratory or subsurface information concerning a project to obtain geothermal energy for use in a process which

changes raw or unfinished materials into another form or generates electric power is filed with the commission, the commission will keep that information confidential for 5 years after the date on which it was first filed with the state engineer and will not disclose it during that period without the express written consent of the operator of the project.
(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.778 Statement of economic feasibility.

The statement of economic feasibility must include or be accompanied by:

1. A detailed statement of the estimated cost of constructing the proposed system, the estimated annual fixed and operating costs of the system, and supporting statements or exhibits showing that the proposed system and its construction are economically feasible.

2. A statement or exhibit showing the applicant's financial ability to render the proposed service, and information regarding the manner in which he proposes to finance the construction and operation of the proposed system. This requirement may be

met by a copy of the applicant's most recent balance sheet and statement of income.

3. A statement or exhibit showing the applicant's managerial and technical qualifications to render the proposed service.

4. A statement identifying any federal, state or local franchise, any water, health or safety permit, and any permit for construction and operation, which the applicant must obtain before operating the proposed system. This statement must also describe the status of the applicant's efforts to obtain any such required franchise or permit.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.780 Additional information to be submitted with application.

In addition to the information required by NAC 704.768 to 704.778, inclusive, an applicant must submit:

1. A description in tariff format of the provisions for:

(a) Rendering bills;

(b) Acting on applications for service;

(c) Handling customers' complaints;

(d) Acting on requests for binding arbitration; and

(e) Operating during an emergency.

2. A copy of the form of contract which the applicant intends to use to comply with the provisions of paragraph (d) of subsection 3 of NRS 704.669.

3. Any further information which is necessary to a full understanding of the application.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.782 Addendum to contract between utility and customer.

The information described in subsection 1 of NAC 704.780 must be included as an addendum to the contract required by paragraph (d) of subsection 3 of NRS 704.669, and the addendum must be attached to the contract document provided to each customer of the utility.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

704.784 Deviation from regulation.

Upon application, the commission will allow a deviation from a provision of NAC 704.760 to 704.782, inclusive, if the commission finds that there is a good cause for the deviation and to allow it would be in the public interest.

(Added to NAC by Pub. Service Comm'n, eff. 12-16-82)

Senator HECHT. Thank you very much.

Mr. Jon B. Wellinghoff, Nevada State consumer advocate.

STATEMENT OF JON B. WELLINGHOFF, NEVADA STATE CONSUMER ADVOCATE

Mr. WELLINGHOFF. Thank you, Senator.

The Attorney General's Office of Consumer Advocate certainly appreciates the opportunity to appear before the subcommittee today and present our comments on the development of geothermal resources in this State.

At the outset I'd like to explain the OCA's perspective on geothermal development. As the subcommittee may be aware, the OCA was created to protect the interests and represent those interests of ratepayers of Nevada's public electric utilities. Thus, our primary focus is to insure the geothermal development will not negatively affect the ratepayers of this State.

Further, our office believes it's necessary to determine if the beneficial uses of geothermal energy for both direct applications, such as space heating, and indirect application, such as the generation of electricity, can be a positive benefit to Nevada's utility customers. My comments today will be primarily directed to these two areas.

Given the necessarily narrow perspective of our office, as mandated by the legislature, I wish to emphasize that any hesitation expressed in these comments regarding the benefit of geothermal development relate only to our utility ratepayer interests. Our comments are not intended to infer any explicit or implicit opposition on our office's perspective on the development of geothermal energy which will benefit this State's economy in general.

In its letter of invitation the subcommittee has asked the office of consumer advocate to address the question of rate and regulatory problems encountered in permitting a public utility to purchase power above its present avoided cost with the projection of much lower levelized costs in the long term. In addressing this question I will attempt to highlight the regulatory concerns which those parties who are vested with protecting ratepayers' interests must consider in reviewing such a proposal.

The question posed by the subcommittee is founded, we believe, on two basic assumptions, which must be fully explored before any decision can be reached regarding the justification of current ratepayers being charged something higher than the current avoided costs for electricity generated by geothermal projects.

In the first instance the question appears to assume that there is a necessity for Nevada utility companies, and therefore, their ratepayers to pay something more than the current avoided costs in order to receive future benefits from geothermal energy. Thus, the first regulatory consideration must be whether that assumption is in fact well founded.

For instance, if Nevada's ratepayers are likely to receive future benefits of lower future costs for electricity without participating in the high front-end development costs through the payment of higher avoided costs, there would be little justification for a regulatory body to authorize payments of anything more than the current avoided costs for geothermal.

Therefore, any party proposing such a transaction, be it a utility company or any other entity, should be prepared to shoulder the burden of demonstrating that front-end Nevada ratepayer participation, in fact, is a condition precedent to the realization of future benefits by Nevada ratepayers.

In addition to assuming that ratepayers must pay something more than current avoided costs to receive the benefit of lower long-term rates, the question further assumes that the payment of something more than current avoided costs will in effect guarantee or at least we hope reasonably assure that ratepayers will receive future benefits.

All of us realize that geothermal development for electric generation will be taking place in a complex interstate environment. In today's environment, California's avoided-cost rates are significantly higher than those in Nevada. That situation may provide an incentive for Nevada geothermal producers to develop geothermal electrical energy for export or yield costs that do not have geothermal competitive with other resources available to Nevada's utilities.

Under such circumstances there is at least a possibility that Nevada ratepayers will not receive the projected long-term benefits of geothermal energy development even if they pay higher costs now and that consideration must be weighed by entities who are charged with protecting ratepayer interests.

Therefore, any proposal that would require Nevada ratepayers to pay more than current avoided costs in order to secure future benefits should demonstrate that Nevada ratepayers will, in fact, receive those future benefits. Assuming that both assumptions are correct, a regulatory entity like the Public Service Commission would still have to determine that there is some equitable justification for requiring today's customers to pay higher costs today for benefits which will benefit future customers tomorrow.

It should be clear from my brief discussion of the assumptions underlying the proposed presentation in our letter of invitation that there are serious regulatory considerations which must be addressed as we approach the eve of geothermal generation in this State. These concerns will not evaporate like wisps of steam in the desert air.

The charge which has been given to regulatory bodies in this State to protect the public interests can only be discharged if there is a thorough and comprehensive evaluation of whether there is a need for ratepayers to pay higher avoided costs on the front end and whether the payment of such costs will really buy ratepayers cheaper energy in the long run.

The Office of Consumer Advocate certainly recognizes many of the potential benefits that could accrue to Nevada ratepayers from geothermal electric generation. Both the location of the resource in Nevada thereby negating long transmission lines and the smaller size of the units which can be more closely matched to Nevada's load growth patterns make geothermal an attractive resource.

However, there must be some assurance these paper benefits be translated into cost benefits to Nevada ratepayers. That is the challenge which faces Nevada utilities, geothermal resource developers, and Federal and State regulatory entities.

I'd like to end my remarks here. I would indicate for the subcommittee's review, as my remarks go on, they do include a number of recommendations that we believe appropriate for Federal action in this area. Thank you.

[The prepared statement of Mr. Wellinghoff follows:]

PRESENTATION OF CONSUMER ADVOCATE JON WELLINGHOFF
BEFORE THE
UNITED STATES SENATE SUBCOMMITTEE
ON ENERGY AND MINERAL RESOURCES
REGARDING GEOTHERMAL DEVELOPMENT IN NEVADA
APRIL 17, 1984

The Attorney General's Office of Consumer Advocate (OCA) certainly appreciates the opportunity to appear before this Subcommitte on Energy and Minerals and present our comments on the development of geothermal resources in this state.

At the outset I would like to explain the OCA's perspective on geothermal resource development. As the Subcommittee may be aware the OCA was created to represent the interest of ratepayers of the Nevada public utility companies. Thus our primary focus is to ensure that geothermal development will not negatively effect the ratepayers of this state. Further, the OCA believes it is necessary to determine if the beneficial uses of geothermal energy both for direct applications such as space heating and indirect application like the generation of electricity can be of positive benefit to Nevada's utility customers. My comments today will be primarily directed to these two issues.

Given the necessarily narrow perspective of our office, as dictated by our legislative mandate, I wish to emphasize that any hesitation expressed in these comments regarding the benefits of geothermal development relate only to OCA's utility ratepayer interests. Our comments are not intended to infer any explicit or implicit opposition on OCA's part to geothermal development which will benefit this state's economy.

In its letter of invitation the Subcommittee has asked the Office of Consumer Advocate to address "rate regulatory problems encountered in permitting a public utility to purchase power above its present 'avoided cost' with the projection of much lower levelized costs in the long term." In addressing this question I will attempt to highlight the regulatory concerns which those parties who are vested with protecting ratepayers' interests must consider in reviewing such a proposal.

The question posed by the Subcommittee is founded upon two basic assumptions which must be fully explored before any decision can be reached regarding the justification of current ratepayers being charged something higher than current avoided costs for electricity generated from geothermal projects. In the first instance the question appears to assume that there is a necessity for Nevada utility companies and therefore their ratepayers to pay something more than current avoided costs in order to receive future benefits from geothermal energy. Thus the first regulatory consideration must be whether that assumption is in fact well founded. For instance, if Nevada's ratepayers are likely to receive "future benefits" of lower future costs for electricity without participating in the high front end development costs through the payment of higher avoided costs, there would be little justification for a regulatory body to authorize payment of anything more than a current avoided costs for geothermal energy. Therefore, any party proposing such a transaction should be prepared to shoulder the burden of demonstrating that front end Nevada ratepayer participation, in fact, is a condition precedent to the realization of future benefits by Nevada ratepayers.

In addition to assuming that ratepayers must pay something more than current avoided costs to receive the benefit of lower long term rates, the question further assumes that the payment of something more than current avoided costs will in effect guarantee or reasonably insure that ratepayers will receive future benefits. All of us realize that geothermal development for electric generation will be taking place in a complex interstate environment. In today's environment California's avoided cost rates are significantly higher than those in Nevada. That situation may provide an incentive for Nevada geothermal producers to develop geothermal electrical energy for export or yield costs that do not leave geothermal competitive with other resources available to Nevada utilities. Under such circumstances there is at least a possibility that Nevada ratepayers will not receive the projected long-term benefits of geothermal energy development even if they pay higher costs now and that consideration must be weighed by entities who are charged with protecting ratepayer interests. Therefore, any proposal that would require Nevada ratepayers to pay more than current avoided costs in order to secure future benefits should demonstrate that Nevada ratepayers will in fact receive those future benefits. Assuming that both assumptions were correct, a regulatory entity like the Public Service Commission would still have to determine that there is some equitable justification for requiring today's customers to pay higher costs today for the benefit of tomorrow's customers.

It should be clear from my brief discussion of the assumptions underlying the proposition presented in our letter of invitation that there are serious regulatory considerations which must be addressed as we approach the eve of geothermal electrical generation in this state. These concerns will not evaporate like a whisp of steam in the desert air. The charge which has been given to regulatory bodies in this state to protect the public interest can only be discharged if there is a thorough and comprehensive evaluation of whether there is a need for ratepayers to pay higher costs on the front end and whether the payment of such cost will really buy ratepayers cheaper energy in the long run.

The Office of Consumer Advocate certainly recognizes many of the potential benefits that could accrue to Nevada ratepayers from geothermal electric generation. Both the location of the resource in Nevada thereby negating long transmission lines and the smaller size of the units which can be more closely matched to Nevada's load growth patterns make geothermal an attractive resource. However, there must be some assurance that these paper benefits will be translated into cost benefits to Nevada ratepayers. That is the challenge which faces Nevada utilities, geothermal resource developers and federal and state regulatory entities.

It is the OCA's opinion that the federal government could play a significant role in insuring that these resources are developed for the benefit of Nevada ratepayers. In the first instance a condition should be added to geothermal leases to require that companies developing geothermal electrical generation facilities on federal geothermal leases maintain and share information regarding the operational history of their facilities. Two, federal financial assistance should be directed to geothermal electrical generation projects that are proposed in known resource areas with demonstrated resources. The emphasis should be on developing and demonstrating technologies to utilize the resources that are known rather than attempting demonstration projects where there are significant resource risks as well as technological risks. Three, the federal government through WAPA or other similar organizations should examine the feasibility of developing transmission facilities that will facilitate expeditious development and utilization of available geothermal resource. Four, consideration should be given to the concept of federal geothermal power projects. And finally, if geothermal is developed as a regional or national energy source, the federal government should be willing to cost share the demonstration of those resources. For instance, several projects have been proposed by geothermal developers in this state which would require Nevada ratepayers to pay something other than other current avoided costs. If those projects are successful, ratepayers in other states and the federal government, as a royalty collector, will receive the benefits of those demonstrations. For these reasons the OCA suggests that more emphasis be placed upon grants or other funding that would pay the difference between the actual and avoided costs for such demonstration projects for geothermal power production.

Although the electrical generation uses of geothermal resources have received predominant emphasis, there is also significant direct use potential in this State. The State of Nevada has attempted to facilitate the development of those resources by restructuring its regulatory framework to protect consumer interests while at the same time providing incentive for development. Despite these reforms and the proximity of geothermal resources to many Nevada communities, the amount of direct use development has been minimal. In large part that can be attributed to many developers' inability to finance and carry geothermal projects through their initial years of development phase. During that period the developers are often faced with large financing and operational costs but a small customer base. The federal government should develop programs that will provide assistance to municipalities and other governmental entities in meeting such costs in the initial years of operation. Potentially this could be done out of a revolving fund established with geothermal rents and royalty money. Unfortunately without such assistance, it is unlikely that ratepayers in this and other states that have direct use potential will be able to utilize this indigenous resource that could help displace requirements for imported natural gas and oil products.

Furthermore, steps should also be taken by the Congress to remove some present barriers to individual use of geothermal resources. These include streamlining the leasing process for small scale direct geothermal applications, revising the 50 degree centigrade limitations in current tax regulations and insuring that any direct assistance funding for private or public development is directed to entities in known resource areas with access to viable resources who have the economic and business viability to complete the project.

Senator Alan Bible's slumbering giant is being prodded and is beginning to stir. Hopefully, the combined efforts of all parties will facilitate the development of geothermal resources to the benefit of ratepayers and taxpayers alike.

Senator HECHT. Thank you very much.

Mr. Pat Landon, county executive, Mineral County.

STATEMENT OF PATRICK LANDON, MINERAL COUNTY EXECUTIVE DIRECTOR

Mr. LANDON. Thank you, Senator Hecht. I am speaking on behalf of Mineral County, Nev. Mineral County is extremely interested in geothermal potential because we see its development as a cornerstone of our local economic development package and as a means for public entities and commercial enterprises to ameliorate the rising costs of keeping our doors open. In Mineral County, several geothermal sites have been identified. More specifically, the area adjacent to and west of Hawthorne has been extensively studied recently.

In February 1981, the Oregon Institute of Technology Geoheat Center studied geothermal possibilities on a well owned by the El Capitan Lodge in Hawthorne, finding a good geothermal heating source.

Later in 1981, Geothermal Development Associates, under a contract, from the Nevada Department of Energy, prepared a preliminary plan for the development of geothermal energy in the town of Hawthorne, Nev.

This report indicated that geothermal wells exist about at the 500 foot level in the Hawthorne vicinity and that the Walker Lake basin has high potential for geothermal development. This is borne out by evidence that a 210 °F well exists at a depth of 1,000 feet approximately 1½ miles southwest of Hawthorne. Thermal activity in existing wells range from 71 °F to 210 °F.

The GDS report concluded that "The geologic and hydrologic evidence suggested the area of highest probability for obtaining a viable geothermal resource is located adjacent to the Wassuk range west of the city of Hawthorne."

The GDA report found that the greatest potential application of geothermal energy at Hawthorne is district hearing. The prospects for commercial application, for example, aquaculture and greenhousing, were not adequately studied. A district hearing system designed to supply space heating and domestic hot water heating for county buildings, public school buildings, commercial buildings, and residential subdivisions appeared to have the greatest benefit potential.

Following this preliminary report, Mineral County hired Chilton Engineering to conduct a geothermal heating system feasibility study based on the recommendations given in the previous study. There were four alternative systems analyzed, ranging in cost from $2.1 million to $1.5 million. Technologically, all of the alternatives proved to be highly feasible.

Economically, none of the alternatives proved feasible using county bonding finances.

Initial analysis was performed on the lowest cost system, which they called the best case, identified in the report which was alternative No. 4. The financing and investment strategy for this alternative involved 100 percent financing through county bond issue.

Analyzing the economics of this alternative, it was found that annual cash flow became positive in the year 10. However, the cumulative present worth of the cash flow did not become positive before year 20, which was the end of the system's lifetime.

Positive present worth is not achieved until year 22. Stated simply, the project's benefits, which are reduced fuel costs and revenues, are not great enough to offest the costs of the system. Thus, this best case proved economically not feasible.

Since the conventional financing/investment strategy proved uneconomical, alternate methods were then investigated. First, an increased revenue base was evaluated. The system, as designed, would create approximately 4,460 thousand Btu's available for sale. Should this be able to be utilized by a commercial or industrial customer, the cumulative present worth becomes positive in year 15, indicating feasibility.

Second, if costs of financing could be reduced, the project may prove to be feasible. That is, if a grant of approximately 25 percent of the package were available or if a very low interest loan were available, this project would become economically feasible using customers as designed.

Because of the viability of this project with financing assistance, Mineral County would like to urge that means be found whereby projects such as these could be assisted financially. Thank you.

Senator HECHT. Thank you very much.

Dr. Gordon Bloomquist, geothermal specialist, Washington State Energy Office.

STATEMENT OF DR. R. GORDON BLOOMQUIST, GEOTHERMAL SPECIALIST, WASHINGTON STATE ENERGY OFFICE

Dr. BLOOMQUIST. Thank you, Senator Hecht. Very pleased to be here today to represent the State of Washington.

We have a great interest in not only our own resources but also the resources of the whole West. At the present time we are under contract to Bonneville Power Administration to assess the geothermal potential of Oregon, Washington, Idaho, Montana, parts of Nevada, California, Utah, and Wyoming. So, we are extremely pleased to be here, and I think that we have probably more to learn than we have to give today.

I would like to say a few things, though, about the State of Washington, about some of the problems that we are having and some of the things we feel the Federal Government can do.

The State of Washington has actively been pursuing the assessment and development of the State's geothermal resources since the mid-1970's. The program has been primarily funded by Federal sources since its beginning, and like many other Western States, we receive money from the National Science Foundation, ERDA, and the U.S. Department of Energy, and most recently from the Bonneville Power Administration.

However, the year-to-year fluctuations in the financing and the restrictions placed upon such financing, in fact, often we serve as no more than a consultant to the Federal Government without meeting our own needs. The State legislature in 1980 passed a bill designed to put the State's geothermal program on a sound financial footing. The bill provided for the distribution of moneys received by the State from Federal geothermal leases and is similar to the so-called Bosco bill in California.

The moneys which the State now receives are distributed to the Department of Natural Resources to pursue exploration, the Washington State Energy Office to promote development, and to the counties of origin to mitigate social, economic, and environmental impacts of exploration and development.

Despite our efforts to promote the development of geothermal resources for electrical generation, the almost total lack of access to Federal lands for such exploration and development has all but precluded the possibility of geothermal development in Washington for electrical. Electrical quality resources in the State are restricted to primarily the Cascade Mountains, an area almost totally under the control of the U.S. Forest Service. The Cascades, as a geological province, have received a great deal of attention, and the industry has applied for more than 1½ million acres of land in the Cascades. However, over a 10-year period since lease applications were first accepted, only 63,000 acres have been leased.

The lack of access to Federal lands has served to force industry to look elsewhere. Many of the original applicants have dropped their applications in disgust.

The lack of leasing has only thwarted the best efforts of industry to engage in exploration, but has also had a profound impact upon the State's desire to make our geothermal program financially self-sustaining and independent.

Thus our desire to gain passage of the Steam Act amendments stems not only from the problems of acreage limitations and lease terms which plague developers in Nevada and much of the rest of the West, but a need to encourage exploration by protecting developers from having new KGRA's created due to exploration activity carried out either by industry or the State, and the need to expedite all leasing decisions consolidated under one agency. In this case, the Bureau of Land Management.

The State of Washington has actively pursued the passage of such legislation, and its passage has been supported by both Governor Ray, Governor Spellman, and of course, the late Senator Henry Jackson.

This legislation has received too little support by this Congress, and we urge that every effort be made to gain its passage during this session. It is very enlightening to talk to your staff and to find your support for this legislation, and we appreciate that a great deal.

The lack of access to high temperature geothermal sites has forced the State to concentrate its efforts on the development of low temperature geothermal resources at the Columbia basin, an area of several hundred square miles underlain by geothermal resources. In order to facilitate the use of these resources, the State has passed legislation to authorize local Government bodies to own, construct, operate, and bond for district heating systems.

Legislation has also been passed which exempts private entities engaged in district heating from traditional public utility regulation of rates based upon rate of return. This exemption also extends to existing regulated utilities for the purposes of engaging in district heating.

Our efforts have been rewarded by the establishment of the Nation's first district heating system to use low temperature geothermal resources together with a heat pump. This first system is a model for many more to come.

The city of Yakima has recently put in a district system for a jail cutting their heating bill by about 80 percent. And it is only the first of many to go in.

Recently we have set out under a local government technical assistance program, which is partially funded from oil overcharge moneys, to assess the district heating potential of all other cities in Washington which have geothermal potential. We have a computer program which allows us to determine the feasibility of such systems from an analysis of heat-load density of any given area, or the number of Btu's which are consumed per acre/year. By the end of this year we will have completed studies of 8 cities, and we have targeted an additional 81 cities which have known geothermal resources within 5 miles of town.

A major impediment to the full development of the State's low temperature resources has, however, been the very arbitrary decision by the Internal Revenue Service to limit geothermal tax credits as established by the 1978 Tax Act to resources above 50 °C.

In Washington, 82.6 percent of the identified resources sites below 90 °C have temperatures below 50 °C, and are ineligible for the tax credit.

The situation is much the same in Oregon, and in Nevada, the percentage of resource site—the Governor mentioned you have better than 300—of those 300, 81.6 percent of your resource sites in Nevada are ineligible for the Federal tax credits.

I should also mention that these resource sites are all above 20 °C and have a substantial energy potential. I have been unable to find any scientific justification for such a temperature limitation by the IRS from either a geologic or an engineering standpoint.

In fact, the U.S. Geological Survey has chosen 10 °C above mean annual ambient temperature for the lower limit in a major study they completed. That would equate to possibly 20 percent Celsius.

The geothermal resources and energy committee of the American Society of Testing and Materials has proposed a definition for geothermal energy to cover the use of Earth resources to as low as 4 °C or 38 °F. A provision of the Deficit Reduction Act of 1984, as passed by the U.S. Senate Committee on Finance, would lower the temperature to 40 °, but the 10 ° temperature reduction would have little effect upon the number of resources which would become eligible for tax credits.

In Washington, 65.2 percent of the identified sites would still be excluded, as would 64 percent of the sites in Nevada.

In fact, if Congress chooses to establish a temperature cutoff now, although it had no such intent when the tax credits were established, it could have a serious negative impact on hundreds of cases which are now before the tax courts.

In conclusion, Senator, we have a tremendous geothermal potential in Washington and throughout much of the West. And although Washington, as well as many other States, are actively engaged in establishing a legal and institutional framework conducive to geothermal development, many of the problems are beyond our control.

The need to pass the Steam Act amendments is as great or greater now than any time since they were first introduced in 1979. And the tax credits which were heralded as a means of encouraging more full utilization of our geothermal resources must be made available to developers of low temperature geothermal systems, if these resources are to be made economically attractive.

The failure to pass Federal legislation which addresses these problems has severely impeded the development of low temperature geothermal resources, as well as development of the most technically and cost effective of the Nation's high temperature geothermal resources. And despite the best efforts of the States, the Federal Government still holds the key to geothermal development. Thank you.

Senator HECHT. Thank you very much.

Mr. Reyburn, would you please provide the subcommittee with a copy of your department's regulation as soon as they are published?

Mr. REYBURN. Sure will.

Senator HECHT. And what does the State of Nevada intend to do with the 50 percent share of Federal royalites when these become available?

Mr. REYBURN. I am not prepared to answer that question right now.

Senator HECHT. I understand that your department of minerals must coordinate with the BLM with respect to geothermal development on Federal lands. How does this work and are there any problems?

Mr. REYBURN. Yes, that is correct. We have not run into any problems yet on geothermal. We have much the same working relationship on BLM lands involving oil and gas.

We have established a very good working relationship between the two departments. One department or one agency cannot issue or they can issue a permit, but you cannot go ahead and do any work without having both of the permits, both from the State and BLM.

Senator HECHT. At the present time Nevada does not impose any excise or severance tax on geothermal energy production. Does the State have any plans to impose such a tax?

Mr. REYBURN. There is none that I know of. But again, I am not in a position to answer that question.

Senator HECHT. I am told that Nevada law requires that an out-of-State utility that develops natural resources in Nevada must allow Nevada utilities to claim 50 percent of the output of any generating plant.

Do you think that this requirement discourages geothermal development in Nevada?

Mr. REYBURN. No, I wouldn't think so. I think the possibiilty still exists for that company, that developing company, to go ahead with its plans.

Senator HECHT. Thank you very much.

Mr. Landon, does your county now have legal authority to sell bonds for the financing of a district heating plant?

Mr. LANDON. We could go under a general obligation bond. We talked with the developer of the El Capitan as well, and they would like to go with a special assessment bond. We have the bonding capability. It is not feasible for us to do it.

Senator HECHT. You said that you see geothermal development as a cornerstone of your local economic development package. You also said that project financing is a big problem.

Do you think that the prospects for project financing will improve in the next few years?

Mr. LANDON. Speaking from private perspective, I imagine they would, particularly in our county. From a public perspective, that is up to you.

Senator HECHT. Do you see any other impediments for geothermal development in Mineral County?

Mr. LANDON. No. Economics purely.

Senator HECHT. What sorts of local economic benefits do you expect from geothermal development?

Mr. LANDON. We have an industrial park located right close to most of the geothermal activity. We would like to bring a line through—a line through the county buildings and the school buildings, provide heat terminated at the industrial park and be able to supply real cheap heat to industrial.

Senator HECHT. Thank you.

Mr. Schmidt, is it premature for you to comment on whether the commission thinks Sierra Pacific should be more directly involved in building geothermal park.

Mr. SCHMIDT. Yes; it would be. That would be something we would address in the Resource Planning Act.

Senator HECHT. Before we continue I want to acknowledge that you were a key player in developing the Hoover Dam legislation that is nearing enactment in Congress, and we appreciate it very much.

Mr. SCHMIDT. Thank you.

Senator HECHT. Would you briefly explain how the PSC has established its avoided-cost pricing principles under section 210 of PURPA? How often does the PSC plan to update its pricing scheme?

Mr. SCHMIDT. The regulation was adopted after hearings that were held in 1980. In early 1981 the regulation was passed. The regulation requires utilities to update its current avoided costs, and the avoided costs is designed in the regulation as the fully avoided costs as laid out in PURPA on an every-3-months basis.

The regulation itself also addresses and indicates the commission's interest and desire to review the regulation on a 6-month basis, but that requires stimulation from outside party. In other words, a party must or should petition the commission to reevaluate the regulation.

I am happy to say today that I'd welcome such a petition. I think that since the rule has not been looked at for 3 years, it is probably appropriate to review it just because of the timelag.

And if we do not receive a petition shortly, I suspect that there will be activity by the commission later in the year to do so on its own. That's the basis on which we review them.

The way in which the regulation was created under PURPA, it is in full compliance with the Federal regulations that were created under section 292 of the Code of Federal Register of Federal Regulations, title 18. The commission under those regulations has some additional authority to establish interconnection arrangements and costs, and rather than get too long winded in my answer here, I would refer you to the language submitted in my testimony which goes into a little bit more detail on those things in the regulation itself.

Senator HECHT. Thank you. Do you have any general thoughts on whether there is a Nevada ratepayer interest in requiring that a certain percentage of our geothermal power be kept in the State?

Mr. SCHMIDT. You mentioned a few minutes ago the Hoover legislation. I found that one of the hardest things that I had to do in the 3 years that I worked in the Attorney General's Office on the Hoover package prior to coming to the commission was to explain to Nevadans why a majority of the Hoover power was sold and consumed in southern California. I think that some foresight now might prevent that same public criticism and lack of understanding in the future.

I don't think that the markets in Nevada can handle all the geothermal potential in Nevada in the near future, perhaps even in several decades. So, for that reason, I wouldn't necessarily say that we should totally discourage sales to California. But I do think that we should evaluate public opinion of that prior to doing so because geothermal resources is important to Nevada, and I think it will be important to the public.

In addition, if I might, before you move on, I would like to respond to a question you asked Mr. Reyburn, since I believe there may be a misconception as to a Nevada statute that may have been referred to. The current Nevada statutes that require Nevada utilities to be offered a percentage of geothermal or other electric generation resources are different for geothermal than for other electric generation facilities. And that exception was recently added by the Nevada Legislature, and the exception allows utilities—allows developers, if utilities do not wish to take the geothermal development to sell out of State without that restriction, the general restriction requires some sort of recapture provision in the contracts with California utilities or other out-of-State utilities. That restriction does not apply to geothermal development, and that is probably an important exception, and I thought that you would want to be aware of it.

Senator HECHT. Thank you very much.

Mr. Wellinghoff.

Mr. WELLINGHOFF. Yes.

Senator HECHT. Your testimony outlined several ideas on how the Federal Government might subsidize the cost of geothermal power to Nevada ratepayers. Are you suggesting that the Government's current incentives, tax credits, PURPA, et cetera, are inadequate or that benefits flow to the wrong party?

Mr. WELLINGHOFF. I am simply suggesting, Senator, that if there are benefits that, in fact, are going to flow from geothermal development in Nevada not only to Nevada but to the rest of the Nation, as far as the information that we are going to gain from this development, No. 1, and also from the Federal royalties as well, that perhaps some of those benefits, those two benefits to the Federal Government in general, should flow back to people in Nevada. And that's basically the rationale I am using for indicating that some of the Federal programs should be looked into.

Senator HECHT. You state that the Federal Government should require the sharing of certain operational history information by developers as a condition of their Federal lease. Are you talking about financial information here?

Mr. WELLINGHOFF. No; I am talking about the technical operating information, the type of plant that they are putting on-line and how those plants operate and whether or not that technology is transferable to other sites, and that type of information I think is very important.

Sierra Pacific has indicated it is important for their contracts that they are becoming involved in, and I'd like to see that as a requirement of Federal leases.

Senator HECHT. If so, isn't this the kind of situation that PURPA was designed to avoid?

Mr. WELLINGHOFF. I'm not certain that it was specifically designed to avoid that. I think if we can share this technology and utilize it in such a manner that it is benefiting not only Nevadans but people in Washington State and other places across the country, then, I think the use of Federal land will be improved in that way.

Senator HECHT. Do you think that Sierra Pacific ought to be more directly involved in geothermal powerplant development at this time?

Mr. WELLINGHOFF. That's somewhat difficult for me to answer. We are about to go into hearings before the Public Service Commission on the three contracts that Sierra Pacific has at this point in time. I think we need to go through those hearings first, explore fully the extent to which Sierra is going to be involved with the three contractors that they have proposed, and determine in the course of those hearings whether or not that involvement is enough.

I think I can probably better answer your question after those hearings. I think we really need to fully explore what the current relationship is with Sierra Pacific and those three contractors, whether it is adequate or inadequate, and if we determine it is inadequate after those hearings, then, I would say yes, that Sierra should become more fully involved. But if those current contracts with these contractors seem adequate and the proposals as set up will benefit Nevada ratepayers, then, I would say no.

I think without having the ability to cross-examine both Sierra and those three contractors in the context of those hearings, I don't think I can answer your questions fully today.

Senator HECHT. What do you think the State should do with geothermal royalties?

Mr. **Wellinghoff.** I think one thing that could be done with those royalties, if ratepayers have to—and this is off with the cuff; I haven't thought of this in great detail.

Senator **Hecht.** I would appreciate your off-the-cuff statements.

Mr. **Wellinghoff.** I will try to give you an answer. If it becomes necessary to get geothermal developers, in fact, to provide electricity in the State at something above avoided cost, then perhaps those State royalties should go to offset the incremental amount above avoided costs the ratepayers are going to pay. I think that may be an appropriate use of that money, at least one possible appropriate use, and I certainly reserve the right to be able to indicate there may be some further appropriate uses of it as well.

Senator **Hecht.** I appreciate those statements because here in Nevada we are a one-on-one basis, and we have no formalities. We want to get the job done. So, don't worry about any off-the-cuff statements.

Our next panel will be panel No. 2, and the first witness is Mr. Edward F. Spang, State director, U.S. Bureau of Land Management.

STATEMENT OF EDWARD SPANG, NEVADA STATE DIRECTOR, BUREAU OF LAND MANAGEMENT, DEPARTMENT OF THE INTERIOR

Mr. **Spang.** I appreciate the opportunity to appear before this subcommittee and discuss the geothermal program in Nevada on public lands. Since you have indicated that the full text of the statement will be in the record, I am going to in the interests of time shorten this by just hitting on some main points.

Senator **Hecht.** Thank you. Your full statement will be in the record.

Mr. **Spang.** Thank you, sir. For the minerals and energy resources, the bureau policy actively encourages and facilitates the development of public land mineral resources in a manner that satisfies national and local needs and provides for economically and environmentally sound exploration, extraction, and reclamation practices.

We classify public land for resource availability, issue leases and regulate the permitting, operations, surface management, and production verification for royalty purposes of geothermal resources on public land in Nevada.

Now, the program has a number of characteristics that I would like to review here briefly. One, I want to start with the resource potential in Nevada. It is a significant geothermal resource and has a great potential for development. In 1978, the USGS estimated that Nevada possessed wellhead thermal energy equal to the heat content of 5.9 billion barrels of oil.

Seventeen areas were identified as having reservoir temperatures in excess of 150 degrees centigrade, the minimum temperature generally regarded as necessary to generate electricity. Potential electrical energy production from these areas are estimated at 2,900 megawatts for 30 years.

While recent exploration has shown that this estimate may be high, the vast potential in Nevada is obvious. The USGS study also identified 28 locations as known to be favorable for the discovery and development of low-temperature, geothermal resources which could be used for different use applications.

The map that is in back depicts, of the panel, depicts generally the potential of geothermal in this state. Very interesting map.

As far as the heating programs are concerned, the Federal leasing programs are concerned in Nevada, we have approximately 40 percent of all the geothermal leases and lease acreage in the United States. These leases and acres under lease in Nevada are more than double that of the next most active geothermal State.

We currently have 547 geothermal leases covering approximately 1 million acres, including both competitive and noncompetitive leases. The Nevada district environmental analysis records for fluids leasing identify that 91 percent of all BLM administered lands in Nevada are open to competitive or noncompetitive leases.

In 1983, these leases returned approximately 1,830,000 in rental fees to the Federal Treasury, of which 50 percent was returned to the State of Nevada. We expect to issue approximately 50 noncompetitive geothermal leases in fiscal year 1984 and will hold a competitive bid geothermal lease sale in late August or early September 1984.

We have classified 24 areas of public land in Nevada as known geothermal resource areas, which is the largest number in any State. A KGRA classification means that the included public lands can only be leased competitively because of the area—because this area has been determined to be a good enough potential to warrant expenditures of money for development.

Within KGRA's over 22,000 acres have been formally declared as being producible. There are an additional 12 leases within Federal geothermal unit agreements whose terms are affected by the determination of the commercial status.

Also we have approved eight Federal geothermal unit agreements which are currently in effect, with over 160,000 acres. Our observation is that the trend has moved from resource exploration to awaiting commercial resource development.

Now a word on Federal program actions. Besides making the resource available, the bureau has also taken several steps to ensure that geothermal development can proceed in a manner consistent with the Geothermal Steam Act and Federal Land Policy Management Act. The existing leasing—the existing leasing regulations were streamlined in April 1983.

The bureau is also currently considering revising the operating regulations to remove regulatory burdens and duplication in the permitting procedures.

In November 1983, we held a general meeting in Reno for the public and geothermal lessees to maintain a dialog between the bureau, other Federal and State agencies, and the public, on a wide range of regulatory, leasing, and environmental issues.

Through this type of communications we hope to keep one another current and up to date on our needs and interests.

Industries' activities on public lands. Industry has been diligently exploring for and delineating geothermal resources in Nevada since the early 1960's. Over that period, more than 100 deep exploration wells have been drilled throughout the State. Such activities did not commence on Federal lands until the issuance of the first Federal geothermal leases in 1974.

The first successful well drilled on Federal land was determined capable of production in commercial quantities as early as 1978. There are now 14 federally determined commercial wells which are capable of producing at least 40 megawatts of electricity in Nevada on Federal lands or in Federal units These wells are located in the Dixie Valley, Desert Peak, Beowawe, and Soda Lake KGRA's.

Two deep wildcat wells are being drilled by industry at this time with an additional deep well scheduled for this summer and fall in the Dixie Valley, Desert Peak, Steamboat KGRA's, and also in Federal leasing units near Tuscarora in Elko County, and Silver Peak in Esmeralda County.

Several low temperature direct-use facilities have been built on fee lands throughout the State in recent years. There is also a growing interest for developing such systems on Federal lands, and in recent months several operators have preliminarily discussed this with our office.

Comment on commercial development. Leasing does not necessarily mean development will occur. As we indicated before, there is no commercial production as yet on Federal land in Nevada. Although, the resource is available.

The lack of full development in Nevada appears to be more due to factors of the free enterprise system, distribution to areas where the power demand exists, and the remoteness of the resource from existing transmission corridors.

The bureau stands ready to work with the free market in bringing Nevada's rich geothermal heritage to fruitful production. We encourage private industry to take up the challenge, and deliver this low-cost, natural resource of energy, to the towns and cities which need additional power.

Modifications of geothermal program. Within this State, with the most geothermal lease acreage, we have identified two areas of concern with the Federal program which can affect future development: One, termination of existing leases with producible wells; and two, the acreage limitation.

In Nevada there are 26 leases which are affected by the commercial producible well determinations and are scheduled to reach the end of their primary period between January 1985 and Septemter 1986.

Diligent expenditures by Federal lessees have totaled over $50 million. The Geothermal Steam Act allows the extension of a geothermal lease if there is a commercial well and a bona fide sales contract or if drilling is occurring across the termination date.

While we expect a position on this issue soon, the change in the law to allow an extension of the primary period for leases with commerical wells seems to be a legislative solution.

The other point of concern is Federal lease acreage limitation within the Geothermal Steam Act. The current accountability limit is 20,480 acres per operator per State.

With the large resource available in Nevada, it appears to us that the lessons learned from the Geothermal Steam Act indicate that a better resource management tool would be to allow a greater acreage limitation. And if my memory serves me right, Senator, you are addressing both of those in a legislative action you are taking at this time.

Senator HECHT. That is correct.

Mr. SPANG. In summary, I want to say that we recommend the potential and significance of the geothermal program in this State. I feel we have been very active in providing it through our leasing program, and we stand ready and willing to help in the development of this program.

[The prepared statement of Mr. Spang follows:]

STATEMENT OF EDWARD SPANG, STATE DIRECTOR, NEVADA STATE OFFICE
BUREAU OF LAND MANAGEMENT
NEVADA FIELD HEARING OF THE SENATE
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
REGARDING THE STATUS OF GEOTHERMAL
DEVELOPMENT IN NEVADA'S GREAT BASIN

APRIL 17, 1984

Mr. Chairman, on behalf of the Bureau of Land Management, I appreciate the opportunity to appear before the subcommittee to discuss the status of geothermal development in Nevada.

The Bureau of Land Management is charged with the management of public lands on the basis of multiple use and balanced development. For mineral and energy resources, BLM policy actively encourages and facilitates the development of public land mineral resources in a manner that satisfies national and local needs and provides for economically and environmentally sound exploration, extraction and reclamation practices. BLM classifies public lands for resource availability, issues leases and regulates the permitting, operations, surface management and production verification for royalty purposes of geothermal resources on public lands in Nevada.

The geothermal program on public lands in Nevada has several major characteristics:

- there is a significant geothermal resource
- there is great potential for development
- the majority of known available resources are already under lease and have been for several years

- there is a steady effort by industry to define resources under lease and to diligently explore and develop the resource
- there is no commercial production on public lands although there are three small projects of 5-10 MW capacity in the planning stages
- the current leasing program is amenable to accelerated development although there are two areas of concern: extension of existing leases with "producible" wells and acreage limitations.

I would like to discuss each of these program aspects briefly.

Resource Potential in Nevada

Nevada has a significant geothermal resource and great potential for development. In 1978, the USGS estimated that Nevada possessed wellhead thermal energy (total potential energy) equal to the heat content of 5.9 billion barrels of oil. Seventeen areas were identified as having reservoir temperatures in excess of 150° C, the minimum temperature generally regarded as necessary to generate electricity. Potential electrical energy production from these areas was estimated at 2900 megawatts for 30 years. While recent exploration has shown that this estimate may be high, the vast potential in Nevada is obvious. The USGS study also identified 28 locations as known to be favorable for the discovery and development of low-temperature geothermal resources which could be used for direct use applications.

Federal Leasing Program

Nevada has approximately 40 percent of all the geothermal leases and lease acreage within the United States. These leases and acres under lease in Nevada are more than double that of the next most active geothermal state. We currently have 547 geothermal leases covering 1,023,101 acres, including both competitive and noncompetitive leases. The Nevada District Environmental Analysis Records for fluids leasing identify that 91% of all BLM administered lands in Nevada are open to competitive or noncompetitive leasing.

In 1983, these leases returned approximately $1,830,000 in rental fees to the Federal Treasury of which 50 percent or approximately $915,000 was returned to the State of Nevada. We expect to issue approximately 50 noncompetitive geothermal leases in FY 84 and will hold a competitive bid geothermal lease sale in late August or early September of 1984. Parcels offered for sale will include relinquished parcels in KGRAs as well as some acreage in previously unoffered KGRAs. The actual lease application rate and exploration activity have slowed somewhat from the activity of the past years.

The Bureau of Land Management has classified twenty-four areas of public lands in Nevada as Known Geothermal Resource Areas, which is the largest number of any state. A KGRA classification means that the included public lands can only be leased competitively because the area has been determined to be, due to geologic determinations, nearby discoveries, and competitive interest, a good enough prospect to warrant expenditures of money for development. As of today, 56 percent of the public land in Known Geothermal Resource Area (KGRA) acreage in Nevada has been leased under competitive bidding procedures with 31 percent still in force. Total high bids received from competitive geothermal sales have exceeded $3,950,000, half of which was distributed to the State of Nevada.

Within KGRAs, 14 leases containing over 22,187 acres have been formally declared by BLM as being "producible". There are an additional 12 leases within Federal geothermal unit agreements whose terms are affected by the determination of commercial status. The BLM has also approved 8 Federal geothermal unit agreements which are currently in effect, with over 160,000 acres.

At this stage in the Federal leasing program, our observation is that the trend has moved from resource exploration to awaiting commercial resource development.

Federal Program Actions

Besides making the resource available, the BLM has also taken several steps to ensure that geothermal development can proceed in a manner consistent with the Geothermal Steam Act and FLPMA. The existing leasing regulations 43 CFR 3200 were streamlined on April 20, 1983. The BLM is also currently considering revising the operating regulations, 43 CFR 3260, to remove regulatory burdens and duplication in the permitting process. In November 1983, we held a general meeting in Reno for the public and geothermal lessees to maintain a dialogue between the Bureau, other Federal and State agencies, and the public on a wide range of regulatory, leasing and environmental issues.

The BLM will, as noted earlier, continue to make the resource available through competitive and noncompetitive leasing.

Industry Activity on Federal Lands

Industry has been diligently exploring for and delineating geothermal resources in Nevada since the early 1960s. Over that period, more than 100 deep exploration wells have been drilled throughout the State. Such activity did not commence on Federal lands until the issuance of the first Federal geothermal leases in 1974. The first successful well drilled on Federal land was determined capable of production in commercial quantities as early as 1978. There are now fourteen Federally determined commercial wells which are capable of producing at least 40 megawatts of electricity in Nevada on Federal land or in Federal units. These wells are located in the Dixie Valley, Desert Peak, Beowawe, and Soda Lake KGRAs. A large portion of this capacity is located in the Dixie Valley KGRA. Capital expenditures by the various operators for exploration, drilling, and resource testing in the four commercially defined areas exceeds $50 million.

Two deep wildcat wells are being drilled by industry at this time on BLM administered land, one in Dixie Valley in central Nevada and the other in Fish Lake Valley in southwestern Nevada. Additional deep tests are scheduled for this summer and fall in the Dixie Valley, Desert Peak, and Steamboat KGRAs and also in Federal leasing units near Tuscarora in Elko County, and Silver Peak in Esmeralda County.

Sierra Pacific Co. recently announced the signing of three contracts for producing 24 megawatts of electricity with geothermal energy. Two of the areas involved are the Desert Peak KGRA which would produce 9 megawatts, and the Darrough Hot Springs KGRA which would produce 10 megawatts. Both these contracts involve Federal land. The third contract is for 5 megawatts and involves fee land in the Steamboat KGRA.

Several low-temperature direct use facilities have been built on fee lands throughout the State in recent years. These include a vegetable dehydration plant at Brady Hot Springs, a district space heating system at Elko, an ethanol production plant and aquiculture facility at Wabuska, and numerous individual home heating systems in the Reno area. There is also growing interest for developing such systems on Federal lands, and in recent months several operators have had preliminary discussions with the BLM in this regard.

Commercial Development

Leasing does not necessarily mean development will occur. As we indicated before, there is no commercial production as yet on Federal lands in Nevada. The BLM has made the resource available. The lack of full development in Nevada appears to be more due to factors of the free-enterprise system, distribution to areas where the power demand exists, and remoteness of the resource from existing transmission corridors.

The Bureau stands ready to work with the free market in bringing Nevada's rich geothermal heritage to fruitful production. We encourage private industry to take up the challenge, and deliver this low-cost, natural source of energy to the towns and cities which need additional power. We are proud of our part in bringing geothermal energy development to its present point. The next steps are up to private industry and the free market system.

Modifying the Geothermal Program

The Geothermal Steam Act is now 14 years old. Within a State with the most geothermal lease acreage, we have identified two areas of concern with the Federal program which can affect future development: termination of existing leases with "producible" wells and acreage limitations.

In Nevada, there are twenty-six leases which are affected by the commercial, "producible" well determinations in Nevada and are scheduled to reach the end of their primary period between January 31, 1985, and September 30, 1986. Diligent expenditures by Federal lessees have totalled over $50 million dollars, far in excess of that which is required by regulation. The Geothermal Steam Act allows the extension of a geothermal lease if there is a commercial well and a bona fide sales contract or if drilling is occurring across the termination date. Most of the twenty-six leases affected by producible wells would begin terminating in eight months. The Bureau is currently studying this issue and is reviewing several options, within its regulatory authority. Options range from offering limited "suspensions" with provisions for diligence to allowing leases to terminate. While we expect a position on this issue soon, a change in the law to allow an extension of the primary period for leases with commercial wells seems to be a legislative solution.

The other point of concern is the Federal lease acreage limitation within the Geothermal Steam Act. The current accountability limit is 20,480 acres per operator per State. With the large resource available in Nevada, it appears to us that the lessons learned from the Geothermal Steam Act indicate that a better resource management tool would be to allow a greater acreage limitation. The Department expects to be ready to address Section 7 of the Act, which provides that at any time after 15 years from the effective date of the Act, the Secretary after public hearings may increase the maximum holding in any one State by regulation not to exceed 51,200 acres.

Summary

The BLM recognizes the significant geothermal resource and potential that exists in the Great Basin of Nevada. Through our leasing and operational programs, we are committed to balanced development in accordance with the principles of multiple use of lands and resources under the Geothermal Steam Act and FLPMA. The resource has been made available and the Federal program is fully prepared to accommodate accelerated development of this outstanding, environmentally sound energy resource.

Senator HECHT. Thank you very much.

Our next witness is Mr. Donald Pearman, who is the Deputy Manager of the San Francisco Operations Office with the U.S. Department of Energy. Thank you very much.

STATEMENT OF RICHARD Du VAL, MANAGER, SAN FRANCISCO OPERATIONS OFFICE, DEPARTMENT OF ENERGY, AS PRESENTED BY DONALD PEARMAN, DEPUTY MANAGER

Mr. PEARMAN. Thank you, Senator, for the opportunity to appear before you today. I will briefly summarize the statement of Richard Du Val, who is the Manager of the Operations Office for the Department of Energy in Oakland. That statement has been submitted for the record.

The emphasis and scope of the Department's current geothermal program is consistent with the national energy policy plan, which was published in October 1983. The goal of this national energy policy is to foster an adequate supply of energy at reasonable costs.

The strategies for achieving this goal include two basic factors: First, promoting a balanced and mixed energy resource system; and second, minimizing Federal control and involvement in energy markets while maintaining public health, safety, and environmental quality.

Renewable energy resources, such as geothermal, can and do play an important role in achieving a balanced and mixed energy supply system. Geothermal resources offer supply diversity, modularity of system size, and flexibility in meeting a variety of end-use demands. Its modularity and flexibility in direct thermal applications, or in electric power generation, make it a highly attractive energy alternative. As technological advances improve economic viability, we can expect an increased diversity within the Nation's energy supply infrastructure and an increase in competition within the energy marketplace. The development of geothermal energy will enhance the ability of the private sector to respond to fluctuations in supply and price of conventional fuels.

The Federal role in geothermal energy research and development is concentrated in areas where the incentives for, and availability of, private investment are severely limited.

Within the policy guidelines of the national energy policy plans, the goal of DOE's Geothermal Energy Program is to help build a technology base that will enable the private sector to economically develop the various forms of geothermal resources.

The Department's geothermal program represents a balance of activities among definition of geothermal resources, applied research, and sufficient exploratory development necessary to establish a technical base to support private sector investment. Specific efforts are designed to develop the engineering tools and acquire the data necessary to reduce technical and economic risks to private sector developers.

Essentially important is the Department's increased emphasis in technology transfer activities, and that was noted by a question of one of the previous witnesses. It is very important to us since the commercial adoption of new energy technology ultimately rests with the private sector. The success of the DOE geothermal R&D

programs is very much dependent upon the prompt and effective transfer of results from federally funded research to the private sector.

Overall, Nevada's geothermal resource potential is substantial. A great deal of effort has been undertaken by the Federal and State governments and the private sectors in identifying, assessing, and utilizing Nevada's geothermal resources, beginning in the 1950's. These efforts have established a sound technical basis for continuing the development of this energy resource within the State.

For example, detailed geothermal resource assessments in Nevada were conducted from 1978 to 1982 under a cooperative program, which used the services of the Nevada State Assessment Team to conduct a statewide evaluation of geothermal resources.

The results of the resources assessment efforts have produced valuable strategic information about Nevada's geothermal potential. The commercial utilization of this resource for both direct heat applications and electric power generation is beginning to expand and a number of commercial ventures are currently in progress.

Technical knowledge gained from these projects and the ongoing research activities are doing much to encourage private sector development.

The current DOE research program is designed to continue to expand the geothermal technology base and to better understand the physical, chemical, and thermodynamic relationships between the resource and the application technologies. The results of this ongoing research will contribute to further technological improvements which offer the opportunity to expand the number and types of economically viable geothermal energy applications.

For example, research is underway in the areas of resource definition, hard rock penetration, well completion technology, heat cycle technology, brine handling and injection, geochemistry and materials, and permeability enhancement which will have relevance to geothermal technology throughout the spectrum of potential applications.

As I have already noted, the Department's major focus on technology transfer as a two-way process helps to ensure that the research needs of industry are considered early in the research planning process and that an adequate mechanism exists to transfer the results of DOE research experiences, and lessons learned, to groups and individuals within the private sector.

A wealth of knowledge, experience, and lessons learned has accumulated through the efforts of a large number of organizations and citizens in the State of Nevada. The DOE Research and Development Program and technology transfer activities are designed to build upon and sustain the momentum achieved to date by cooperative efforts between industry and Government. If our research and development efforts prove successful, additional opportunities for geothermal development will continue to materialize.

Senator, I thank you for the opportunity to present this brief summary of DOE's longstanding involvement in the development of geothermal energy in Nevada, and appreciate your attention. Thank you.

[The prepared statement of Mr. Du Val follows:]

STATEMENT OF

RICHARD DU VAL

MANAGER, SAN FRANCISCO OPERATIONS OFFICE

Mr. Chairman and Members of the Committee:

Thank you for the opportunity to appear before you today to discuss the status of geothermal development in Nevada's Great Basin, and to highlight some key activities which have contributed to an improved understanding of the geothermal resource potential in Nevada and the commercial application of this renewable energy resource. The Department of Energy (DOE) serves as the lead agency for federal R&D in establishing the technology base to facilitate private sector development of geothermal energy resources. The Department's generic and specific contributions in resource assessments, technology development, feasibility analysis, technical risk reduction, and technology transfer provide the technological tools for geothermal development.

Today I will describe the basis for the federal geothermal energy program and present an overview of Nevada's geothermal resource potential, the current status of geothermal application projects, and the Department's current research activities.

DEPARTMENT OF ENERGY POLICIES AND STRATEGIES

The emphasis and scope of the Department's current geothermal program is consistent with the National Energy Policy Plan (NEPP-IV), published in October 1983. The goal of this national energy policy is to foster an adequate supply of energy at reasonable costs. An adequate supply requires a flexible mix of energy systems that avoids undue dependence on any single source of supply, foreign or domestic, and thereby contributes to our national security and economic stability. The strategies for achieving this goal include:

- o Promoting a balanced and mixed energy resource system, and
- o Minimizing federal control and involvement in energy markets while maintaining public health, safety and environmental quality.

Renewable energy resources, such as geothermal, can play an important role in achieving a balanced and mixed energy supply system. Geothermal resources offer supply diversity, modularity of system size, and flexibility in meeting a variety of end use demands. Its modularity and flexibility in direct thermal applications, or in electric power generation, make it a highly attractive energy alternative. As technological advances improve economic viability, we can expect an increased diversity within the nation's energy supply infrastructure and an increase in competition within the energy marketplace. The development of geothermal energy will enhance the ability of the private sector to respond to fluctuations in supply and price of conventional fuels.

The federal role in geothermal energy research and development is concentrated in areas where the incentives for, and availability of, private investment are severely limited. In these areas, competitive rates of return on technology development investments cannot be realized by private firms due to the high-risk nature of the R&D investment, lack of an adequate market and/or service infrastructure, or due to the exceptionally long lead times required before returns begin.

Within the guidelines of NEPP-IV, the goal of DOE's Geothermal Energy Program is to help build a technology base that will enable the private sector to economically develop the various forms of geothermal resources. The Department's geothermal program represents a balance of activities among definition of geothermal resources, applied research, and sufficient exploratory development necessary to establish a technical base to support private sector investment. Specific efforts are designed to develop the engineering tools and acquire the data necessary to reduce technical and economic risks to private sector developers.

Especially important is the Department's increased emphasis in technology transfer activities. Since the commercial adoption of new energy technology ultimately rests with the private sector, the success of the DOE geothermal R&D programs is very much dependent upon the prompt and effective transfer of results from federally-funded research to the private sector.

STATUS OF GEOTHERMAL ENERGY DEVELOPMENT IN NEVADA

RESOURCE POTENTIAL

The Basin and Range physiographic province, which includes most of Nevada, has an abnormally high heat flow, associated primarily with young volcanic formations. Deep hot water reservoirs account for virtually all of Nevada's commercially developable geothermal resources. Northern Nevada also contains numerous hot springs related to subsurface ground water circulation.

Overall, Nevada's geothermal resource potential is substantial. Thirty Nevada sites have been designated by the U.S. Geological Survey (USGS) as Known Geothermal Resource Areas (KGRA's), and over 300 additional sites are believed to have exploitable geothermal potential. Nevada resources display a wide variety of temperatures, from less than 20°C up to 230°C (68°F to 446°F), with the highest temperature resources located in the northern portion of the state. Several high temperature hydrothermal resource sites, such as Beowawe, Brady Hot Springs, Humbolt House, and Desert Peak, show good potential for electric power generation. It is estimated that the combined electric power potential from Nevada's geothermal resources is over 2500 MWe.

The majority of Nevada's geothermal reservoirs have temperatures between 20° and 150°C (68°F and 302°F), which is the prime temperature range for direct-heat application such as space heating, agricultural operations, and industrial process heating. Many promising geothermal sites are co-located with major population centers such as Reno, Las Vegas, and Carson City, making them even more attractive for development. Estimates indicate that by the year 2000, direct applications of geothermal energy have the potential to supply about 5% of this state's energy consumption.

Status of Development

A great deal of effort has been undertaken by the federal and state governments and the private sector in identifying, assessing, and utilizing Nevada's geothermal resources, beginning in the 1950's. These efforts have established a sound technical basis for continuing the development of this energy resource within the state. For example, detailed geothermal resource assessments in Nevada were conducted from 1978 to 1982 under a cooperative program, which used the services of the Nevada State Assessment Team to conduct a statewide evaluation of geothermal resources.

Additionally, DOE participated in the northern Nevada Industry-Coupled Drilling Program. This program, which was designed to share with private developers the risks associated with drilling into largely undefined resource areas, has contributed much to the understanding of the resource base. The Department also funded the preparation of an updated geothermal resource map by the National Oceanic and Atmospheric Administration, in part utilizing resource information provided by the Earth Sciences Division of the University of Nevada, Reno.

The results of the resource assessment efforts have produced valuable strategic information about Nevada's geothermal potential. The commercial utilization of this resource for both direct heat applications and electric power generation is beginning to expand and a number of commercial ventures are currently in progress.

The total installed capacity of the geothermal electric power plants of the U.S. today is about 1350 MWe. In addition, several power plants, with a total rated capacity of 655 MWe, are currently under construction. Like geothermal electric projects elsewhere in the U.S., Nevada power projects are temporarily constrained by the otherwise desirable features of the current energy marketplace--stable energy prices and a short-term electrical power capacity surplus. To encourage private developers, the 1983 session of the Nevada Legislature has passed legislation allowing geothermal developers to export electrical energy from Nevada without Nevada utility involvement. Accordingly, local geothermal developers now have an increased incentive to sell power to other states, where growing power markets may provide a profitable outlet for Nevada's geothermal power. Several areas within the State are candidate sites for power plants. Beowawe and the Navy's Fallon Site are currently being studied for near-term power production. For example, a joint venture between Chevron and O'Brien Resources contemplates commercial development at Beowawe. The first stage would include a 5 to 10 MWe hot water power plant by 1985. Continuing development at this location could yield eventual power levels of 200 MWe or more.

There are also a large number of successful geothermal energy direct-heat projects being developed by the private sector in Nevada. The technical knowledge gained from these projects and the ongoing research activities are doing much to encourage private sector development.

For example, resource assessment information supported by DOE at the Moana area not far from here, in southwest Reno, was utilized by private developers to drill at least 150 geothermal wells to supply heat and hot water to nearly 200 homes, commercial buildings and churches. A recently completed final report of the geology and hydrology of the Moana resource performed by the University of Nevada's Division of Earth Sciences, delineated the size, depth, and temperature range of the resource and confirmed that this location has the largest low-to-moderate-temperature geothermal resource in Nevada.

In another example, a geothermal food dehydration plant has been constructed at the Brady Hot Springs resource with a $3.5 million private loan guarantied by the Department's Geothermal Loan Guaranty Program. This onion dehydration plant is the first of its kind in the U.S. to use a geothermal heat source.

The plant produces 6 million dry pounds of onions annually during the six-month season. The geothermal energy replaces about 116 billion Btu of natural gas annually at a savings of over a quarter of a million dollars.

At another commercially successful geothermal location in Elko, Nevada, direct heat applications include space and domestic water heating for a four-story office complex; space, domestic water and swimming pool heating for a hotel/casino complex; and process heat for a commercial laundry. As of April 1983 each user became independent of natural gas. Several additional users, including a bank and a city sewage plant, have joined the system; and a hotel, a hospital and a school district have expressed interest in the project.

Another important Departmental activity in support of private sector geothermal development is the sponsorship of Technical Assistance Centers. Several feasibility studies for direct-heat application of geothermal energy, performed by the DOE Technical Assistance Centers, have resulted in the development of successfully completed projects. For example, feasibility studies and technical support activities in Nevada have been performed for projects in Reno, Sparks, Caliente, Hawthorne, Fernley, and Gerlach, covering a wide range of applications from district space heating and domestic hot water, to industrial process heat and gasohol production.

CURRENT RESEARCH PROGRAM

The current DOE research program is designed to continue to expand the geothermal technology base, and to better understand the physical, chemical, and thermodynamic relationships between the resource and the application technologies. The results of this ongoing research will contribute to further technological improvements which offer the opportunity to expand the number and types of economically viable geothermal energy applications. For example, research is underway in the areas of resource definition, hard rock penetration, well completion technology, heat cycle technology, brine handling and injection, geochemistry and materials, and permeability enhancement which will have relevance to geothermal technology throughout the spectrum of potential applications.

Current DOE research in the area of reservoir definition, will permit an improved identification and characterization of the resource through the development of downhole temperature/pressure instruments for low-to-moderate temperature well testing; the development of engineering methodologies and computer codes for understanding fault charged reservoirs and hot water recharge rates; and the evaluation of various surface and sub-surface geophysical techniques to locate natural fracture systems within the reservoir with sufficient accuracy to more successfully target drilling.

In the areas of hard rock penetration and well completion technology, DOE research is focussed on understanding the basic mechanics of rock penetration; development of techniques and instruments for mapping wellbore fractures so that they can be cemented to reduce or prevent fluid circulation loss, an important problem for private developers; and development of downhole high-temperature instruments and sensors to accurately monitor the drilling direction. In addition, nonconventional drilling techniques such as water-jets, spallation drilling, and drilling with continuous tubing are being investigated in an effort to reduce the cost of well drilling, a major factor in the overall economic feasibility of geothermal applications. Development of techniques to more efficiently complete the well are expected to lead to higher production rates and lower redrilling and maintenance costs for the developer.

Additionally, important R&D activity involves the understanding of the thermodynamics of various geothermal heat cycles and the development of efficient and reliable components to generate power from moderate-temperature geothermal resources. The technology to economically utilize this relatively large resource base will significantly expand the power generation potential in Nevada.

Specific research activities include the characterization of the thermophysical properties of binary cycle working fluids; the evaluation of innovative heat exchanger, condensor, and heat rejection systems; and the testing of downhole pumps which has the potential to substantially increase production from established wells.

To further improve the productivity and longevity of production and injection wells, DOE is conducting research on methods to enhance the permeability of the reservoir. New techniques to create fractures in reservoir rock and to stimulate fluid flow in porous media should increase the technical and economic viability of geothermal energy. For example, recent well stimulation tests at Beowawe by Chevron successfully used DOE developed acid treatment techniques to more than double brine injection rates.

These and other research activities relating to hydrothermal, geopressured, hot dry rock, and magma energy resources are all designed to assist the private sector in establishing additional geothermal alternatives.

The Department's major focus on technology transfer as a two-way process helps to ensure that the research needs of industry are considered early in the research planning process and that an adequate mechanism exists to transfer the results of DOE research experiences, and "lessons learned" to groups and individuals within the private sector. For instance, the DOE Geothermal Technical Assistance Centers provided up to 100 hours of technical and general assistance to potential users and developers, by performing economic and engineering feasibility studies, producing follow-up reports, and disseminating direct-use information.

Additionally, an important set of upcoming technology transfer activities relate to joint industry/government field testing and development. Geothermal developers and operators have formed a voluntary, non-profit organization to fund and conduct joint projects with DOE. This organization's contribution of funds, equipment, manpower, and field resources to such joint projects will increase the return to the national economy of government R&D investments, and accelerate the rate of information sharing regarding the specific potential of geothermal technology.

CONCLUSIONS

The state of Nevada has a significant base of potentially recoverable geothermal energy in the Great Basin region. The Department of Energy, in conjunction with the state and private sector, has played an important role in the assessment and development of this state's geothermal energy resource. DOE's past activities have contributed to the current technical base which supports commercial development of this valuable renewable energy source within the state. The Department continues to be an active participant in expanding the field of geothermal technology through its current research programs, technical assistance, and technology transfer efforts.

A wealth of knowledge, experience, and "lessons learned" has accumulated through the efforts of a large number of organizations and citizens in Nevada. Geothermal resource assessment data; geologic, geochemical and geophysical data; drilling and exploration data; case histories of residential and commercial direct-use applications; geothermal resource maps, publications, and pamphlets; and knowledgeable institutions, and technical assistance centers can all provide the residents of Nevada with the information needed for further geothermal development. The DOE Research and Development Program and technology transfer activities are designed to build upon and sustain the momentum achieved to date by cooperative efforts between industry and government. If our R&D efforts prove successful, additional opportunities for geothermal development will continue to materialize.

I thank the committee for the opportunity to present this brief summary of DOE's long standing involvement in the development of geothermal energy in Nevada and appreciate your kind attention.

Senator HECHT. Thank you very much.

Capt. Paul Austin, commander, Fallon Naval Air Station, Fallon, Nev.

STATEMENT OF CAPT. PAUL B. AUSTIN, U.S. NAVY, COMMANDING OFFICER, NAVAL AIR STATION, FALLON, NEV.

Captain AUSTIN. Good morning, Senator Hecht. I appreciate the opportunity to review the Navy's geothermal development in Nevada's Great Basin.

However, before I address the geothermal development, I would like to briefly discuss the mission of the naval air station, an understanding of which is important to understand our reasons for proceeding with the geothermal development.

The naval air station is a unique facility in the U.S. Navy's aviation community. With an electronic warfare range and bombing ranges colocated in the same geographic area, the station offers the most realistic combat training scenarios available to both experienced pilots and those young naval aviators just beginning their careers in defense of the United States.

NAS Fallon has facilities to support a deployed carrier air wing, consisting of in excess of 70 aircraft and over 1,500 personnel.

During 1983, NAS Fallon hosted 10 air wings, over 900 aircraft, and over 17,000 personnel. The training these units receive is invaluable when the various squadrons enter the highly unforgiving environment of carrier operations.

In order to provide better, more efficient services to deploying squadrons and air wings, as well as allowing the air station to operate more economically, several military construction projects are in various stages of planning and completion.

These improvements signal Naval Air Station Fallon's growing importance to the Navy's aviation community. Other developments, some new this year, also point to the expansion of the air station's mission.

The arrival of fighter/attack squadron 125's detachment of F/A-18's, the home porting of attack squadron 127, and the locating of the newly developed strike leaders school at Naval Air Station Fallon, all hold special significance in the continuing history of the air station.

The U.S. Navy has been among the forefront of the pioneering organizations in the development of an understanding of geothermal deposits, including their definition, their identification, and their exploration.

The entry of the Navy into the geothermal exploration and development field began in the early 1960's, when a Navy scientist published a report that indicated steam, with underlying brines, would be found at the naval weapons center in China Lake, Calif.

Developing its ideas further, the Navy, in cooperation with the American Institute of Mining, metallurgical and petroleum engineers, presented its concepts on the selection criteria for geothermal prospects at the Pacific Southwest Mineral Industry Conference held in Sparks, Nev., in May 1965.

Taking its exploration ideas into the field, the Navy drilled its first exploratory well in 1966, finding 289 °F. fluids at the shallow depth of 375 feet on Naval Weapons Center, China Lake.

In 1971, the Navy published a study entitled "Geothermal Science and Technology: A National Program."

This study was ultimately published in its entirety in the hearings before the Committee on Interior and Insular Affairs, U.S. Senate, in 1972.

With successful completion of the identification of a major potential geothermal resource on Navy lands in California in 1977, the Navy set out to establish a mechanism for placing these in useful production at no capital cost to the Navy.

Worth noting is that the Navy subsequently contracted with private industry to develop the Coso Geothermal and also in cooperation with Department of Interior enabled the Department of the Interior to conduct a lease sale at Coso.

In 1981, the Navy contractor's discovery well encountered clean dry steam and flowed at a rate of 170,000 pounds per hour, providing a tremendous incentive for private industry to bid on the Department of the Interior lease sale.

The Navy continued its field exploration efforts, including studies at Adak, Alaska, a good prospect, at Lualualei, Oahu, also a good prospect, and at the excellent appearing prospect at Hawthorne, Nev.

The Fallon site was chosen by the Navy, based on the Navy's evaluation of the resource potential and a detailed analysis of the naval air station mission on both a short- and long-term basis. Concluding that a geothermal development program could be integrated with the station's mission, the Navy set out to gather sufficient data of interest to industry and responsibly called for bids.

The Navy estimates for the power potential of Navy lands at Fallon are 100 megawatts at main site, 250 megawatts at the Bravo 16 range, and 150 megawatts at the Bravo 19 range. With this encouraging data in hand, the Navy decided to seek a contractor to explore main site Fallon and Bravo 16 and Bravo 19.

Sections 2394 and 2689 of title 10, United States Code, authorize the secretary of each military department to develop any geothermal resources within lands under his jurisdiction, and to contract for the provision and operation of energy production facilities and the purchase of energy produced from such facilities for a period not to exceed 30 years, subject to the approval of the contract by the Secretary of Defense and to the notification of the committees on armed services and on appropriations of the Senate and House of Representatives.

Acting on this authority, the Western division, Naval Facilities Engineering Command issued an invitation for bid on August 12, 1982, for developing the geothermal resource at the Naval Air Station, Fallon. A contract was awarded on April 29, 1983, to General Ener-Tech, Inc., of San Diego, Calif.

Under the contract, the contractor has agreed to explore, evaluate, and develop the resource, construct and operate power plants, and deliver up to 75 megawatts of geothermally produced electricity to the Navy at the air station at no capital costs to the Department of Defense. The contractor will be reimbursed for these services at a rate based on his bid price of 3.94 cents per kilowatt-hour of electricity actually delivered to the Navy. This price will be adjusted semiannually by a Navy developed economic index.

This development must be in compliance with the geothermal resources operational orders issued by the Department of the Interior, and these orders establish mandatory requirements for exploratory operations, for drilling and spacing of wells, plugging and abandonment of wells, and general environmental protection requirements.

Assuming the presence of adequate resource, the contract calls for development of not less than 15 megawatts of power within 5 years of contract award, and not less than 50 megawatts within 7 years.

Electrical power that becomes available beyond the 5 megawatts requirement of the Naval Air Station will serve the electric requirements of other naval and Department of Defense installations in the western region.

The Navy signed a letter of agreement with the Western Area Power Administration, Department of Energy, on December 17, 1982, in which Western Area Power Administration agreed to act as the Navy's power transmission and marketing agent for the geothermal project at Naval Air Station.

The contractor is also presently selecting drill sites. His plans for drilling and testing at least three wells during the period of July to December 1984.

The Western Area Power Administration is currently discussing possible transmission arrangements with the Sierra Pacific Power Co. It is planned to negotiate a specific agreement from making the power delivered by the contractor at the Naval Air Station available to other naval and Department of Defense installations in the western region as soon as a firm schedule of power deliveries has been established.

In conclusion, the objective of the Navy geothermal program is to provide a technical and economic data base to provide for utilizing geothermal resources to supply electrical power and space heating and cooling at appropriate naval shore installations, when economics dictate resource development, and/or when encroachment pressure of private exploration efforts impact the ability of individual bases to perform their assigned missions.

The Navy geothermal plan is a coordinated approach to attain the above-stated program. We believe we have been successful.

Our success, however, is due to a well-conceived Navy geothermal plan, which was first published in 1980. This plan is currently under review and will be reissued this calendar year.

It is our road map, and I will be happy to provide the committee a copy of the revision when it is published. Thank you.

[The prepared statement of Captain Austin follows:]

STATEMENT OF
CAPTAIN PAUL B. AUSTIN, U. S. NAVY
COMMANDING OFFICER, NAVAL AIR STATION, FALLON, NEVADA

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE:

I AM CAPTAIN PAUL B. AUSTIN, COMMANDING OFFICER, NAVAL AIR STATION, FALLON, NEVADA. I APPRECIATE THE OPPORTUNITY TO REVIEW THE NAVY'S GEOTHERMAL DEVELOPMENT IN NEVADA'S GREAT BASIN WITH YOU.

MISSION OF NAVAL AIR STATION, FALLON, NEVADA

BEFORE I ADDRESS GEOTHERMAL DEVELOPMENT, I WOULD LIKE TO BRIEFLY DISCUSS THE MISSION OF NAVAL AIR STATION, FALLON, NEVADA. AN UNDERSTANDING OF OUR MISSION IS IMPORTANT TO UNDERSTANDING OUR REASONS FOR PROCEEDING WITH GEOTHERMAL DEVELOPMENT.

THE OFFICIAL MISSION STATEMENT FOR NAS FALLON IS:

"TO OPERATE AND MAINTAIN AN AIRFIELD AND ASSOCIATED BOMBING AND ELECTRONIC WARFARE RANGES IN ORDER TO PROVIDE WEAPONS TRAINING FOR TACTICAL AVIATION UNITS OF THE NAVY, MARINE CORPS AND SUCH OTHER AVIATION UNITS AS MAY BE DIRECTED BY THE CHIEF OF NAVAL OPERATIONS."

NAVAL AIR STATION, FALLON IS A UNIQUE FACILITY IN THE U. S. NAVY'S AVIATION COMMUNITY. WITH AN ELECTRONIC WARFARE RANGE AND BOMBING RANGES CO-LOCATED IN THE SAME GEOGRAPHIC AREA, THE STATION OFFERS THE MOST REALISTIC COMBAT TRAINING SCENARIOS AVAILABLE TO BOTH EXPERIENCED PILOTS AND THOSE YOUNG NAVAL AVIATORS JUST BEGINNING THEIR CAREERS IN DEFENSE OF THE UNITED STATES.

NAS FALLON HAS FACILITIES TO SUPPORT A DEPLOYED CARRIER AIR WING, CONSISTING OF APPROXIMATELY 70 AIRCRAFT AND OVER 1,500 PERSONNEL. DURING 1983, NAS FALLON HOSTED 10 AIR WINGS, OVER 900 AIRCRAFT, AND OVER 17,000 PERSONNEL. THE TRAINING THESE UNITS RECEIVE IS INVALUABLE WHEN THE VARIOUS SQUADRONS ENTER THE HIGHLY UNFORGIVING ENVIRONMENT OF CARRIER OPERATIONS.

IN ORDER TO PROVIDE BETTER, MORE EFFICIENT SERVICES TO DEPLOYING SQUADRONS AND AIR WINGS, AS WELL AS ALLOWING THE AIR STATION TO OPERATE MORE ECONOMICALLY, SEVERAL MILITARY CONSTRUCTION PROJECTS ARE IN VARIOUS STAGES OF PLANNING AND COMPLETION. THESE PROJECTS INCLUDE:

A WEAPONS LOADING PAD, LOCATED AWAY FROM OTHER AIRCRAFT AND PERSONNEL, IS A HIGH PRIORITY FOR THE AIR STATION. THE $11.9 MILLION PROJECT WILL PROVIDE FOR FAST LOADING AND UNLOADING OF ORDNANCE WHILE PROVIDING THE SAFEST ENVIRONMENT FOR BOTH EQUIPMENT AND PERSONNEL. A CONSTRUCTION CONTRACT WAS AWARDED FOR THIS PROJECT ON 23 MARCH 1984. OTHER WEAPONS FACILITY IMPROVEMENTS ARE PLANNED AT A COST OF $4.7 MILLION.

OTHER PLANNED PROJECTS INCLUDE AN AIRCRAFT REFUELING STATION, RUNWAY IMPROVEMENTS, A CONSOLIDATED FIRE STATION, WAREHOUSING AND UNACCOMPANIED PERSONNEL HOUSING.

THESE IMPROVEMENTS SIGNAL NAVAL AIR STATION FALLON'S GROWING IMPORTANCE TO THE NAVY'S AVIATION COMMUNITY. OTHER DEVELOPMENTS, SOME DUE THIS YEAR, ALSO POINT TO THE EXPANSION OF THE AIR STATION'S MISSION. THE ARRIVAL OF FIGHTER/ATTACK SQUADRON 125'S DETACHMENT OF F/A-18S, THE HOMEPORTING OF ATTACK SQUADRON 127 AND THE LOCATING OF THE NEWLY DEVELOPED STRIKE LEADERS SCHOOL AT NAVAL AIR STATION FALLON, ALL HOLD SPECIAL SIGNIFICANCE IN THE CONTINUING HISTORY OF THE AIR STATION. THE STRIKE LEADERS SCHOOL, BEING ESTABLISHED TO TRAIN BOTH AVIATORS AND CARRIER OPERATIONS PERSONNEL IN THE THEORIES AND PRACTICE OF STRIKE WARFARE, WILL NECESSITATE THE BUILDING OF SCHOOL FACILITIES IN THE FUTURE.

THE NAVY GEOTHERMAL PROGRAM

THE UNITED STATES NAVY HAS BEEN AMONG THE FOREFRONT OF THE PIONEERING ORGANIZATIONS IN THE DEVELOPMENT OF AN UNDERSTANDING OF GEOTHERMAL DEPOSITS, INCLUDING THEIR DEFINITION, THEIR IDENTIFICATION, AND THEIR EXPLORATION.

THE ENTRY OF THE NAVY INTO THE GEOTHERMAL EXPLORATION AND DEVELOPMENT FIELD BEGAN IN THE EARLY 1960'S WHEN A NAVY SCIENTIST PUBLISHED A REPORT THAT INDICATED STEAM, WITH UNDERLYING BRINES, WOULD BE FOUND AT THE NAVAL WEAPONS CENTER IN CHINA LAKE, CALIFORNIA.

DEVELOPING ITS IDEAS FURTHER, THE NAVY, IN COOPERATION WITH THE AMERICAN INSTITUTE OF MINING, METALLURGICAL AND PETROLEUM ENGINEERS, PRESENTED ITS CONCEPTS ON THE SELECTION CRITERIA FOR GEOTHERMAL PROSPECTS AT THE PACIFIC SOUTHWEST MINERAL INDUSTRY CONFERENCE HELD IN SPARKS, NEVADA, IN MAY 1965. THIS DETAILED TECHNICAL PRESENTATION WAS SUBSEQUENTLY PUBLISHED BY THE NEVADA BUREAU OF MINES IN 1966.

TAKING ITS EXPLORATION IDEAS INTO THE FIELD, THE NAVY DRILLED ITS FIRST EXPLORATORY WELL IN 1966, FINDING 289°F FLUIDS AT THE SHALLOW DEPTH OF 375 FEET ON NAVAL WEAPONS CENTER, CHINA LAKE LANDS.

IN 1971 THE NAVY PUBLISHED A STUDY ENTITLED: "GEOTHERMAL SCIENCE AND TECHNOLOGY: A NATIONAL PROGRAM." THE THRUST OF THIS PAPER WAS:

> "THE MAJOR PORTION OF THE GEOTHERMAL PROSPECT CALLED THE COSO THERMAL AREA LIES WITHIN THE INSTRUMENTED TEST RANGES OF THE NAVAL WEAPONS CENTER, CHINA LAKE, CALIFORNIA. IN DEVELOPING PLANS FOR SCIENTIFIC UTILIZATION OF THE COSO THERMAL AREA, THE STATE-OF-THE-ART OF GEOTHERMAL SCIENCE AND TECHNOLOGY WAS REVIEWED. THE REVIEW INDICATED THAT THE DEVELOPMENT OF GEOTHERMAL DEPOSITS FOR THE PURPOSE OF

> GENERATING ELECTRICITY, PROVIDING HEAT, AND OBTAINING RAW MATERIALS WAS A TECHNOLOGY IN ITS INFANCY, WITH CRITICAL ASPECTS SUBJECT TO UNCERTAINTY. THIS STUDY HAS RESULTED IN A PROPOSAL FOR A NATIONAL GEOTHERMAL SCIENCE AND TECHNOLOGY ADVANCEMENT PROGRAM WHICH WILL BE ACCOMPLISHED BY GATHERING SCIENTIFIC AND ENGINEERING DATA FROM FIVE SELECTED SITES REPRESENTING EACH OF THE FIVE PRINCIPAL TYPES OF GEOTHERMAL DEPOSITS THAT ARE KNOWN OR HYPOTHESIZED."

THIS STUDY WAS ULTIMATELY PUBLISHED IN ITS ENTIRETY IN THE HEARINGS BEFORE THE COMMITTEE ON INTERIOR AND INSULAR AFFAIRS, UNITED STATES SENATE IN 1972. AN OUTGROWTH OF THIS EFFORT WAS A JOINT U.S. NAVY - U.S. DEPARTMENT OF ENERGY - U.S. DEPARTMENT OF INTERIOR (GEOLOGICAL SURVEY) STUDY OF THE COSO GEOTHERMAL SYSTEM. WITH SUCCESSFUL COMPLETION OF THE IDENTIFICATION OF A MAJOR POTENTIAL GEOTHERMAL RESOURCE ON NAVY LANDS IN CALIFORNIA IN 1977, THE NAVY SET OUT TO ESTABLISH A GEOTHERMAL PROGRAM TO IDENTIFY GEOTHERMAL RESOURCES ON NAVY LANDS AND TO ESTABLISH A MECHANISM FOR PLACING THESE IN USEFUL PRODUCTION AT NO CAPITAL COST TO THE NAVY, WHILE PROTECTING AND WHERE POSSIBLE, ENHANCING THE NAVY MISSION AT SUCH INSTALLATIONS AS MIGHT HAVE GEOTHERMAL RESOURCES.

THE FIRST STEP IN THIS PROGRAM OF GEOTHERMAL DEVELOPMENT WAS THE CREATING OF THE GEOTHERMAL UTILIZATION DIVISION OF THE NAVAL WEAPONS CENTER IN 1977. THIS ORGANIZATION WAS ASSIGNED THE RESPONSIBILITY TO ESTABLISH THE NEEDED LEGAL/INSTITUTIONAL MECHANISMS TO ENABLE RESOURCE DEVELOPMENT AND TO IDENTIFY WHATEVER THERMAL EQUITY THE NAVY MIGHT HAVE AT ITS BASES WORLDWIDE.

THE LEGAL/INSTITUTIONAL EFFORT WAS CULMINATED BY SECTION 803 OF THE MILITARY CONSTRUCTION AUTHORIZATION ACT OF 1979 AND SECTION 908 OF THE MILITARY CONSTRUCTION AUTHORIZATION ACT OF 1982, NOW EMBODIED IN TITLE 10 UNITED STATES CODE 2689 AND TITLE 10 UNITED STATES CODE 2394. THESE PROVIDE FOR CONTRACTING AUTHORITY AS WELL AS AN ORDERLY INTERFACE BETWEEN THE INTERESTS OF THE DEPARTMENT OF INTERIOR AND DEPARTMENT OF DEFENSE ON LANDS CONTROLLED BY THE DEPARTMENT OF DEFENSE WITH A GEOTHERMAL POTENTIAL.

WORTH NOTING IS THAT THE NAVY SUBSEQUENTLY CONTRACTED WITH PRIVATE INDUSTRY TO DEVELOP THE COSO GEOTHERMAL AND ALSO IN COOPERATION WITH DEPARTMENT OF INTERIOR ENABLED THE DEPARTMENT OF INTERIOR TO CONDUCT A LEASE SALE AT COSO. IN 1981, THE NAVY CONTRACTOR'S DISCOVERY WELL ENCOUNTERED CLEAN DRY STEAM AND FLOWED AT A RATE OF 170,000 LBS/HR PROVIDING A TREMENDOUS INCENTIVE FOR PRIVATE INDUSTRY TO BID ON THE DEPARTMENT OF INTERIOR LEASE SALE THERE.

THE NAVY CONTINUED ITS FIELD EXPLORATION EFFORTS, INCLUDING STUDIES AT ADAK, ALASKA (A GOOD PROSPECT) AT LUALUALEI, OAHU, (ALSO A GOOD PROSPECT) AND AT THE EXCELLENT APPEARING PROSPECT AT HAWTHORNE, NEVADA. THIS LATTER PROJECT WAS PLACED ON HOLD WHEN ADMINISTRATION OF HAWTHORNE PASSED FROM THE NAVY TO THE ARMY. THE NEXT CONTINENTIAL U.S. SITE SELECTED FOR STUDY WAS THE NAVAL AIR STATION AT FALLON, NEVADA.

THE FALLON SITE WAS CHOSEN BY THE NAVY, BASED ON THE NAVY'S EVALUATION OF THE RESOURCE POTENTIAL AND A DETAILED ANALYSIS OF THE NAVAL AIR STATION MISSION ON BOTH A SHORT AND LONG TERM BASIS. CONCLUDING THAT A GEOTHERMAL DEVELOPMENT PROGRAM COULD BE INTEGRATED WITH THE STATION MISSION, THE NAVY SET OUT TO GATHER SUFFICIENT DATA TO INTEREST INDUSTRY IN RESPONDING TO A CALL FOR BIDS, AGAIN FOR A DEVELOPMENT CONTRACT AT NO CAPITAL COST TO THE NAVY.

NAVY CONTROLLED LAND AT FALLON EXISTS AS SEPARATE DISCRETE BLOCKS. EACH WAS STUDIED. RANGE BRAVO-20 WAS FOUND TO HAVE A LIMITED AND VERY DEEP POTENTIAL AND THE RESULTS OF THIS STUDY WERE PUBLISHED IN 1980. ALSO IN 1980, THE NAVY PUBLISHED THAT RANGE BRAVO-17 AND THE SHOAL SITES HAD SUCH A LOW POTENTIAL FOR GEOTHERMAL ENERGY THAT NO FURTHER STUDY WAS WARRANTED. ON THE OTHER HAND, STUDIES OF RANGE BRAVO-16, RANGE BRAVO-19 AND THE MAIN BASE SHOW A DEFINITE POTENTIAL AT EACH ONE, AS WAS ALSO PUBLISHED IN 1980 BY THE NAVY. IN 1982 THE NAVY PUBLISHED THE RESULTS OF FURTHER STUDIES AND CONCLUDED:

> "THE RESULTS INDICATE THAT NAS FALLON HAS A HIGH GEOTHERMAL POTENTIAL WHILE RANGE BRAVO-16 AND RANGE BRAVO-19 HAVE A BETTER THAN AVERAGE GEOTHERMAL POTENTIAL BETTER EVALUATED BY FURTHER WORK."

THE NAVY ESTIMATES FOR THE POWER POTENTIAL OF NAVY LANDS AT FALLON ARE 100 MEGAWATTS AT MAINSIDE, 250 MEGAWATTS AT RANGE BRAVO-16 AND 150 MEGAWATTS AT RANGE BRAVO-19. WITH THIS ENCOURAGING DATA IN HAND, THE NAVY DECIDED TO SEEK A CONTRACTOR TO EXPLORE MAINSIDE FALLON AND RANGES BRAVO-16 AND BRAVO-19.

GEOTHERMAL POWER DEVELOPMENT

SECTIONS 2394 AND 2689 OF TITLE 10, UNITED STATES CODE, AUTHORIZE THE SECRETARY OF EACH MILITARY DEPARTMENT TO DEVELOP ANY GEOTHERMAL RESOURCES WITHIN LANDS UNDER HIS JURISDICTION, AND TO CONTRACT FOR THE PROVISION AND OPERATION OF ENERGY PRODUCTION FACILITIES AND THE PURCHASE OF ENERGY PRODUCED FROM SUCH FACILITIES FOR A PERIOD NOT TO EXCEED 30 YEARS, SUBJECT TO THE APPROVAL OF THE CONTRACT BY THE SECRETARY OF DEFENSE AND TO THE NOTIFICATION OF THE COMMITTEES ON ARMED SERVICES AND ON APPROPRIATIONS OF THE SENATE AND HOUSE OF REPRESENTATIVES.

ACTING ON THIS AUTHORITY, THE WESTERN DIVISION, NAVAL FACILITIES ENGINEERING COMMAND ISSUED AN INVITATION FOR BID ON 12 AUGUST 1982 FOR DEVELOPING THE GEOTHERMAL RESOURCE AT THE NAVAL AIR STATION, FALLON, NEVADA. A PRE-BID CONFERENCE WAS HELD ON 31 AUGUST 1982, BIDS WERE RECEIVED ON 21 OCTOBER 1982, AND AFTER NOTIFYING THE APPROPRIATE CONGRESSIONAL COMMITTEES ON 14 JANUARY 1983, A CONTRACT WAS AWARDED ON 29 APRIL 1983 TO GENERAL ENER-TECH, INC., OF SAN DIEGO, CALIFORNIA. A NOVATION LATER OCCURRED ON 6 DECEMBER 1983, THE NEW PARTY TO THE CONTRACT BECOMING HELIOSCIENCE GENERAL, JOINT VENTURE, WHICH IS COMPRISED OF GENERAL ENER-TECH, INC., AND HELIOSCIENCE, INC., OF NEW YORK.

UNDER THE CONTRACT, THE CONTRACTOR HAS AGREED TO EXPLORE, EVALUATE, AND DEVELOP THE RESOURCE, CONSTRUCT AND OPERATE POWER PLANTS, AND DELIVER UP TO 75 MEGAWATTS OF GEOTHERMALLY PRODUCED ELECTRICITY TO THE NAVY AT NAVAL AIR STATION, FALLON AT NO CAPITAL COST TO THE DEPARTMENT OF DEFENSE. THE CONTRACTOR WILL BE REIMBURSED FOR THESE SERVICES AT A RATE BASED ON HIS BID PRICE OF 3.94 CENTS PER KILOWATT-HOUR OF ELECTRICITY ACTUALLY DELIVERED TO THE NAVY. THIS PRICE WILL BE ADJUSTED SEMIANNUALLY BY A NAVY DEVELOPED ECONOMIC INDEX. THESE ADJUSTMENTS ARE, HOWEVER, CONSTRAINED BY A CEILING RATE THAT IS BASED ON THE PRICE OF POWER AVAILABLE TO THE NAVY FROM ALTERNATE CONVENTIONAL SOURCES.

THE CONTRACTOR HAS BEEN GRANTED A REAL ESTATE ENTRY PERMIT TO SOME 45,000 ACRES (APPROXIMATELY 70 SQUARE MILES) WHERE HE HAS EXCLUSIVE GEOTHERMAL DEVELOPMENT RIGHTS. THIS DEVELOPMENT MUST BE IN COMPLIANCE WITH THE GEOTHERMAL RESOURCES OPERATIONAL ORDERS ISSUED BY THE DEPARTMENT OF THE INTERIOR UNDER THE GEOTHERMAL STEAM ACT OF 1970. THESE ORDERS ESTABLISH MANDATORY REQUIREMENTS FOR EXPLORATORY OPERATIONS, DRILLING AND SPACING OF WELLS, PLUGGING AND ABANDONMENT OF WELLS, AND GENERAL ENVIRONMENTAL PROTECTION REQUIREMENTS.

ASSUMING THE PRESENCE OF AN ADEQUATE RESOURCE, THE CONTRACT CALLS FOR DEVELOPMENT OF NOT LESS THAN 15 MEGAWATTS OF POWER WITHIN 5 YEARS OF CONTRACT AWARD AND NOT LESS THAN 50 MEGAWATTS WITHIN 7 YEARS. SHOULD THE DIRECT UTILIZATION (NON-ELECTRIC USE) OF THE RESOURCE FOR SPACE HEATING OF BUILDINGS OR THE RECOVERY OF GEOTHERMAL BY-PRODUCTS BECOME FEASIBLE, A CHANGE ORDER TO THE CONTRACT WILL BE NEGOTIATED.

ELECTRIC POWER THAT BECOMES AVAILABLE BEYOND THE 5 MEGAWATTS REQUIREMENT OF NAVAL AIR STATION, FALLON WILL SERVE THE ELECTRIC REQUIREMENTS OF OTHER NAVAL AND DEPARTMENT OF DEFENSE INSTALLATIONS IN THE WESTERN REGION. BECAUSE THE EXISTING LOCAL ELECTRIC UTILITY SYSTEM DOES NOT HAVE ADEQUATE EXCESS CAPACITY AVAILABLE TO PERMIT THE TRANSMISSION OF FULL PROJECT POWER TO OTHER NAVY LOADS IN THE REGION, THE NAVY SIGNED A LETTER OF AGREEMENT WITH THE WESTERN AREA POWER ADMINISTRATION, DEPARTMENT OF ENERGY, ON 17 DECEMBER 1982 IN WHICH WESTERN AREA POWER ADMINISTRATION AGREED TO ACT AS THE NAVY'S POWER TRANSMISSION AND MARKETING AGENT FOR THE GEOTHERMAL PROJECT AT NAVAL AIR STATION, FALLON.

THE CONTRACTOR IS PRESENTLY SELECTING DRILL SITES, PREPARING THE ENVIRONMENTAL DOCUMENTATION REQUIRED FOR EXPLORATORY DRILLING, AND COMPLETING THE FINANCIAL ARRANGEMENTS NECESSARY TO FUND THE EXPLORATORY PHASE OF THE PROJECT. HIS PLANS CALL FOR DRILLING AND TESTING AT LEAST THREE WELLS DURING THE PERIOD OF JULY TO DECEMBER 1984. THE PREPARATION OF A SCHEDULE FOR POWER DELIVERIES WILL BE DEPENDENT UPON THE RESULTS OF THIS EXPLORATORY EFFORT.

THE WESTERN AREA POWER ADMINISTRATION IS CURRENTLY DISCUSSING POSSIBLE TRANSMISSION ARRANGEMENTS WITH THE SIERRA PACIFIC POWER COMPANY, THE SOUTHERN CALIFORNIA EDISON COMPANY, AND THE LOS ANGELES DEPARTMENT OF WATER AND POWER. SIERRA PACIFIC POWER COMPANY HAS INDICATED A WILLINGNESS TO COOPERATE WITH

WESTERN AREA POWER ADMINISTRATION AND THE NAVY IN ARRANGING FOR THE TRANSMISSION OF GEOTHERMALLY PRODUCED POWER TO OTHER UTILITY SYSTEMS. BOTH SOUTHERN CALIFORNIA EDISON COMPANY AND LOS ANGELES DEPARTMENT OF WATER AND POWER HAVE TRANSMISSION LINES IN EASTERN CALIFORNIA THAT CONNECT WITH THE SYSTEMS SERVING MAJOR NAVY LOADS IN SOUTHERN CALIFORNIA. IN ADDITION, LOS ANGELES DEPARTMENT OF WATER AND POWER IS INVOLVED WITH THE DEVELOPMENT OF THE INTERMOUNTAIN POWER PROJECT, WHICH WHEN COMPLETE WILL PROVIDE A DIRECT CURRENT LINE FROM UTAH TO VICTORVILLE IN SOUTHERN CALIFORNIA. IT IS PLANNED TO NEGOTIATE A SPECIFIC ARRANGEMENT FOR MAKING THE POWER DELIVERED BY THE CONTRACTOR AT NAVAL AIR STATION, FALLON AVAILABLE TO OTHER NAVAL AND DEPARTMENT OF DEFENSE INSTALLATIONS IN THE WESTERN REGION, AS SOON AS A FIRM SCHEDULE OF POWER DELIVERIES HAS BEEN ESTABLISHED.

SUMMARY CONCLUSION

THE OBJECTIVE OF THE NAVY GEOTHERMAL PROGRAM IS TO PROVIDE A TECHNICAL AND ECONOMIC DATA BASE TO PROVIDE FOR UTILIZING GEOTHERMAL RESOURCES TO SUPPLY ELECTRICAL POWER AND SPACE HEATING AND COOLING AT APPROPRIATE NAVAL SHORE INSTALLATIONS, WHEN ECONOMICS DICTATE RESOURCE DEVELOPMENT, AND/OR WHEN ENCROACHMENT PRESSURE OF PRIVATE EXPLORATION EFFORTS IMPACT THE ABILITY OF INDIVIDUAL BASES TO PERFORM THEIR ASSIGNED MISSIONS.

THE NAVY GEOTHERMAL PLAN IS A COORDINATED APPROACH TO ATTAIN THE ABOVE STATED PROGRAM OBJECTIVE. THIS WILL BE ACCOMPLISHED THROUGH A PROGRAM ADDRESSING: (A) ALL R&D EFFORT THAT WILL DETERMINE THE EXISTENCE OF A RESOURCE AND PROVIDE THE TECHNICAL INFORMATION ON THE FEASIBILITY OF PROCEEDING WITH DEVELOPMENT OF THE RESOURCE, (B) RESOURCE DEVELOPMENT PHASE WHICH WILL INVOLVE SOLICITATION, ADMINISTRATION AND MANAGEMENT OF A CONTRACT FOR THE DEVELOPMENT OF THE GEOTHERMAL RESOURCE. WE BELIEVE WE HAVE BEEN SUCCESSFUL. OUR SUCCESS, HOWEVER, IS DUE TO A WELL CONCEIVED NAVY GEOTHERMAL PLAN, WHICH WAS FIRST PUBLISHED IN 1980. THAT PLAN IS CURRENTLY UNDER REVIEW AND WILL BE RE-ISSUED THIS CALENDAR YEAR. IT IS OUR ROADMAP, AND I WILL BE HAPPY TO PROVIDE THE COMMITTEE A COPY OF THE REVISION WHEN IT IS PUBLISHED.

I WELCOME ANY QUESTIONS THAT YOU MIGHT HAVE AT THIS TIME.

Senator HECHT. Thank you very much.

Captain Austin.

Mr. Spang.

Mr. SPANG. Yes, sir.

Senator HECHT. In your opinion, would geothermal developers be quick to expand their leaseholdings in Nevada if Congress raised the current State acreage limitation?

Mr. SPANG. I would think there would probably be some of that, yes, because we have some individuals right now, our companies right now that are up against that particular acreage limitation.

Senator HECHT. Do you believe that where geothermal lessees have producing wells but do not have a contract for the sale of the energy from these wells, that they should have to relinquish their leases pursuant to section 6d of the Geothermal Steam Act? Do you know whether or not the Secretary has any authority under these conditions to grant a suspension under section 11 of the Geothermal Steam Act thus extending the lease term?

Mr. SPANG. To the first part of the question, a lot of the reasons why it can't be developed are really not controllable by the individuals or the companies that drill the well.

On the second part, yes, there is a possibility or is a provision whereby extension could be provided upon a hearing by the secretary, and he is considering that option now.

Senator HECHT. Thank you.

Mr. Pearman, you said that a geothermal food dehydration plant has been constructed at the Brady Hot Springs with a $3.5 million private loan guaranteed by DOE geothermal loan guarantee program. How does a geothermal loan guarantee program work?

Mr. PEARMAN. Basically, one would submit a loan guarantee application. In this instance, the San Francisco operations office operates that program for the agency. That application would have to be looked at from technical feasibility standpoints to see if private sector financing could be made available.

If it appears that the risks are great enough to cause interest from the DOE standpoint, but too great for a bank to finance it without a guarantee, then the Department will enter into a situation where we will bring together the financial institution and the individual with the proposal and agree on a loan guarantee wherein in the event of a default, the Department of Energy will pay back the financial institution.

Senator HECHT. Are there other projects in Nevada that could utilize this program?

Mr. PEARMAN. When you say the projects, I think that there are probably opportunities in Nevada that could utilize the program. I think it is dependent upon whether folks could interest the financial institutions and submit the proper type of proposal. But I think there may be opportunities.

Senator HECHT. Is there any money in this program at the present time?

Mr. PEARMAN. Is there any money in the program?

Senator HECHT. Yes.

Mr. PEARMAN. There are several applications that are in process, yes, and there are several projects that are underway.

[Subseqent to the hearing Mr. Pearman submitted the following information:]

Status of Loan Guaranty Program

However, in 1982 pending applications exceeded the Department's remaining loan guaranty authority. Accordingly, only pending applications and follow-up projects for existing DOE loan guarantees are being considered for additional financial backing at this time.

Senator Hecht. Thank you.

Captain Austin, as I understand it, Federal law requires that any power generated on a military base be sold for use on that or other military bases.

Wouldn't the Navy get a better deal by selling its geothermal power to Southern California Edison, for example?

Captain Austin. I think that would depend on what Southern California proposed. But Congress has mandated that the Navy develop assets or DOE be used within the Department of Defense——

Senator Hecht. Do you want to push that down so everyone can hear you?

Captain Austin. The Congress has mandated that assets on DOD land be used within the DOD establishment in order to reduce the enormous energy consumption budget.

Senator Hecht. Is the Navy now participating in any joint efforts to construct a transmission intertie with Southern California Edison?

Captain Austin. No. As I understand it, we have made an agreement with WAPA, and they will negotiate the transmission of the energy.

Senator Hecht. Some concern has been raised by geothermal developers in Dixie Valley that the Navy's proposed airspace restrictions could kill any further development in that area. Can you give this committee an update on the status of this proposal?

Captain Austin. I believe you are talking about the land withdrawals, and that is not the case. The land withdrawal will not interfere substantially with any developments there. The land withdrawal now calls for anything that is in existence to remain in existence.

Anything that is yet to be done, proposed on the land, must be proposed as it normally is through the Bureau of Land Management. BLM then will be required to come to the Navy with the proposal, and we then will be able to voice our objections should the proposal be such that it is incompatible with the aviation being conducted in that area.

Based on our information, that geothermal development should not be one of those type of things that would be prohibited or even stymied very much at all by land withdrawal.

Senator Hecht. How about construction of a transmission line? Would that be a problem?

Captain Austin. There would be a problem depending on where they actually were and the actual height above the ground. There are existing transmission lines there now that we have to live with because they are there.

What we want to do is avoid such obstructions that the Navy could no longer operate there and therefore have to consider moving the air station out of the State of Nevada, which I don't think is one of the things Nevada would like to see. Neither would we.

Senator HECHT. Before I dismiss this panel, I just want to make a personal observation commander. I think you should be commended because in your position, not only do you have to be a complete specialist on naval warfare and flying, but now you walked into a position in Nevada where you have to be a geothermal scientist at the same time. So, don't you long for the days when you can go back and be a Navy commander.

Captain AUSTIN. Yes. They never told me anything about this in flight school.

Senator HECHT. Thank you very much.

Would panel 3 please come up?

Panel 3. Mr. Robert L. Wright, land manager, Phillips Geothermal Division. Mr. Wright.

Mr. WRIGHT. Thank you, Mr. Chairman, for inviting me to appear here today to address geothermal development in the State of Nevada.

Is that too loud?

Senator HECHT. Fine.

STATEMENT OF ROBERT L. WRIGHT, LAND MANAGER OF GEOTHERMAL OPERATIONS, PHILLIPS PETROLEUM CO.

Mr. WRIGHT. My name is Bob Wright. I am land manager of geothermal operations for Phillips Petroleum Co. I also presently serve as chairman of the Western Oil & Gas Association's Geothermal Committee which monitors and addresses pending issues pertinent to the geothermal industry.

Phillips' geothermal operations are headquartered in Salt Lake City with exploration and/or development activities in most of the Western States. We are presently developing the first commercial geothermal project in the United States to be located outside of the State of California.

Our Roosevelt Hot Springs project, under contract with Utah Power & Light, will be furnishing steam for generating electricity this month. The project is located on Federal leases in southwestern Utah.

It is most appropriate that these hearings have been brought to the State of Nevada. Phillips believes that Nevada is a premiere State for potential geothermal development, and we have backed this belief with significant investments in the State.

Phillips and Sierra Pacific Power Co. have entered into a contract for sale of electricity from our Desert Peak project located about 60 miles east of Reno. Phillips will construct a 9-megawatt powerplant and sell the power to Sierra Pacific. The contract with Sierra Pacific will hopefully receive Nevada Public Service Commission approval this month. This project is also located on Federal acreage and is in a federally approved unit.

In addition to developing the Desert Peak project, we have discovered resources at Steamboat Springs, Soda Lake, and Humboldt House, in the State of Nevada. Again, all of these areas involve Federal acreage.

S. 883, pending before your full committee, contains several provisions which would rectify a number of problems facing geothermal development in Nevada and other Western States.

No. 1 is the extension of lease terms on existing leases is the primary problem facing our industry. The majority of the most valuable Federal leases in existence today were issued in 1974 and 1975, and are approaching the end of their primary 10-year term within the next year or two.

In the State of Nevada, there are currently 28 leases on which commercial wells have been drilled or that have such well offsetting same, or are in Federal approved units that will expire within the next 2 years. This represents all of the resources that have been discovered to date in this State.

Under the present regulations, the only method of extending a lease is to have a contract to sell the resource and to be in actual production before the end of the primary term.

The current lack of a market in this State has precluded or delayed operators from actually breaking the lease mentioned into production.

A reasonable solution to this inequity would be the extension of a lease term for an additional 10-year period in cases where production cannot be commenced due to market conditions and where substantial investment in the development of the leasehold for electric generation purposes has been made.

The extension of primary lease terms is desperately needed and soon. The due diligence requirements presently in the leases serve to discourage a lessee from simply sitting on acreage unless development intentions do exist. Without participation by local utilities and extension of lease terms, the value of these leases is going to be lost to the State, the Federal Government, and to the geothermal industry for many years.

The second of our industry's two major problems is the need to increase the present State/Federal acreage limitation from 20,480 to 51,200 acres. A quick look at Nevada can explain this vital need.

The area between Reno and Elko contains the area of highest heat flow in the United States. This area is also comprised of 86 percent Federal acreage.

Within this region lie many discoveries: Desert Peak, Soda Lake, Dixie Valley, Humboldt House, Beowawe, Steamboat Springs, Salt Wells, Stillwater, and others. Because a single geothermal reservoir often involves many thousands of acres, the operators of these discoveries are already precluded from developing other prospects because the acreage limitation has stopped them at just one prospect.

In essence, the strict acreage ceiling prohibits the geothermal industry from conducting a more aggressive exploration program. This situation is also present in other promising Western States. More conventional competing sources, such as oil and gas, enjoy far greater Federal acreage limitations than does geothermal. They are almost 250,000.

By the way, this State is currently enjoying an oil and gas boom of sorts. There is 5 wells drilling and 14 scheduled, and I can assure you that this wouldn't be going on if they could only hold 20,000 acres, and had a lack of market. They can truck their resource out to Salt Lake or Bakersfield, Calif.

Senate bill 883, which has been pending before the Senate Energy Committee for many months, contains responsible language for correcting the problems of primary lease extensions and acreage increases. This legislation also contains several other provisions, such as a change in the definition of a KGRA, which we feel is very appropriate.

While we do not see the need for parks protection language in this particular legislation, Phillips, nonetheless, would support a reasonable parks provision such as that contained in 883, to address the Yellowstone Park-Island Park concerns.

Senate bill 883 contains many other beneficial provisions which I have not attempted to address. Phillips believes that the passage of this legislation would promote the future development of geothermal energy and would provide relief for most of the problems from a Federal perspective.

Again, however, the lease extension and acreage increase provisions are the two items that we need the most in the State of Nevada at this time.

Thank you, Senator.

[The prepared statement of Mr. Wright follows:]

STATEMENT OF ROBERT L. WRIGHT
PHILLIPS PETROLEUM COMPANY
BEFORE THE
SENATE SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
SPARKS, NEVADA
APRIL 17, 1984

THANK YOU MR. CHAIRMAN FOR INVITING ME TO APPEAR TODAY TO ADDRESS GEOTHERMAL DEVELOPMENT IN THE STATE OF NEVADA, AND TO DISCUSS THE GEOTHERMAL LEGISLATION PRESENTLY PENDING BEFORE THE SENATE ENERGY AND NATURAL RESOURCES COMMITTEE.

MY NAME IS BOB WRIGHT, I AM LAND MANAGER OF GEOTHERMAL OPERATIONS FOR PHILLIPS PETROLEUM COMPANY. TO QUALIFY MYSELF AS A WITNESS ON THIS SUBJECT, I HAVE HAD SOME 33 YEARS OF EXPERIENCE IN RESOURCE DEVELOPMENT ON PUBLIC LANDS COVERING OIL AND GAS, HARD ROCK MINERALS AND GEOTHERMAL RESOURCES. I HAVE DEALT WITH THE LEASING ASPECTS OF GEOTHERMAL ENERGY FOR THE PAST 12 YEARS. I ALSO SERVE AS CHAIRMAN OF THE WESTERN OIL AND GAS ASSOCIATION'S GEOTHERMAL COMMITTEE WHICH MONITORS AND ADDRESSES PENDING ISSUES PERTINENT TO THE GEOTHERMAL INDUSTRY.

PHILLIPS' GEOTHERMAL OPERATIONS ARE HEADQUARTERED IN SALT LAKE CITY WITH EXPLORATION AND/OR DEVELOPMENT ACTIVITIES IN MOST OF THE WESTERN STATES. WE ARE PRESENTLY DEVELOPING THE FIRST COMMERCIAL GEOTHERMAL PROJECT IN THE UNITED STATES TO BE LOCATED OUTSIDE OF THE STATE OF CALIFORNIA. OUR ROOSEVELT HOT SPRINGS PROJECT, UNDER CONTRACT WITH UTAH POWER AND LIGHT, WILL BE FURNISHING STEAM FOR GENERATING ELECTRICITY THIS MONTH. THE PROJECT IS LOCATED ON

Federal leases in Southwestern Utah.

It is most appropriate that these hearings have been brought to the State of Nevada. Phillips believes that Nevada is a premier state for potential geothermal development and we have backed this belief with significant investments in the State, which we feel will make a near-term contribution to Nevada's energy needs. Phillips and Sierra Pacific Power Company have entered into a contract for sale of electricity from our Desert Peak Project located only about 60 miles east of where we are presently sitting. Phillips will construct a 9 MW power plant and sell the power to Sierra Pacific. The contract with Sierra Pacific will hopefully receive Nevada Public Service Commission approval this month. This project also involves Federal acreage and is located in a federally approved unit.

In addition to developing the Desert Peak Project, we have discovered resources at Steamboat Springs, Soda Lake and Humboldt House in the State of Nevada. Again, all of these areas involve federal acreage.

Senate Bill 883, pending before your full Committee, contains several provisions which would rectify a number of the regulatory and other problems facing geothermal development in Nevada and other Western States.

Extension of Lease Terms

The extension of lease terms on existing leases is one of two primary needs facing our industry. The majority of the most valuable federal leases in existence today were issued in 1974 and

1975, AND ARE APPROACHING THE END OF THEIR PRIMARY 10 YEAR TERM WITHIN THE NEXT YEAR OR TWO.

IN THE STATE OF NEVADA, THERE ARE CURRENTLY 28 LEASES ON WHICH COMMERCIAL WELLS HAVE BEEN DRILLED, OR THAT HAVE SUCH WELLS OFFSETTING SAME, OR ARE IN FEDERAL APPROVED UNITS THAT WILL EXPIRE WITHIN THE NEXT TWO YEARS. UNDER THE PRESENT REGULATIONS THE ONLY METHOD OF EXTENDING A LEASE IS TO HAVE A CONTRACT TO SELL THE RESOURCE AND TO BE IN ACTUAL PRODUCTION BEFORE THE END OF THE PRIMARY TERM OF THE LEASE.

THE CURRENT LACK OF A MARKET IN THIS STATE HAS PRECLUDED OR DELAYED OPERATORS FROM ACTUALLY BRINGING THE LEASES MENTIONED INTO PRODUCTION.

A REASONABLE SOLUTION TO THIS INEQUITY WOULD BE THE EXTENSION OF A LEASE TERM FOR AN ADDITIONAL 10 YEAR PERIOD IN INSTANCES WHERE PRODUCTION CAN NOT BE COMMENCED DUE TO MARKET CONDITIONS AND WHERE SUBSTANTIAL INVESTMENT IN DEVELOPMENT OF THE LEASEHOLD FOR ELECTRICAL GENERATION PURPOSES HAS BEEN MADE.

THE EXTENSION OF PRIMARY LEASE TERMS IS DESPERATELY NEEDED AND SOON BY THE GEOTHERMAL INDUSTRY. THE DUE DILIGENCE REQUIREMENTS CONTAINED IN PRESENT LEASES SERVE TO DISCOURAGE A LESSEE FROM SIMPLY SITTING ON ACREAGE UNLESS DEVELOPMENT INTENTIONS DO EXIST. WITHOUT PARTICIPATION BY LOCAL UTILITIES AND EXTENSION OF LEASE TERMS THE VALUE OF THESE LEASES WILL BE LOST TO THE STATE, THE FEDERAL GOVERNMENT AND TO THE GEOTHERMAL INDUSTRY FOR MANY YEARS.

ACREAGE INCREASE

THE SECOND OF OUR INDUSTRY'S TWO MAJOR PROBLEMS IS THE

NEED TO INCREASE THE PRESENT STATE FEDERAL ACREAGE LIMITATION FROM 20,480 ACRES TO 51,200 ACRES. A QUICK LOOK AT NEVADA CAN EXPLAIN THIS VITAL NEED.

THE AREA BETWEEN RENO AND ELKO CONTAINS THE AREA OF HIGHEST HEAT FLOW IN THE UNITED STATES. THIS AREA IS ALSO COMPRISED OF 86 PERCENT FEDERAL ACREAGE. WITHIN THIS GEOGRAPHICAL REGION LIE MANY DISCOVERIES - DESERT PEAK, SODA LAKE, DIXIE VALLEY, HUMBOLDT HOUSE, BEOWAWE, STEAMBOAT SPRINGS, SALT WELLS, STILLWATER, ETC. BECAUSE A SINGLE GEOTHERMAL RESERVOIR OFTEN INVOLVES MANY THOUSANDS OF ACRES, THE OPERATORS OF THESE DISCOVERIES ARE ALREADY PRECLUDED FROM DEVELOPING OTHER PROSPECTS BECAUSE THE 20,480 ACRE LIMITATION HAS LIMITED THEM TO JUST ONE PROSPECT IN THIS VERY POTENTIAL AREA. IN ESSENCE, THE STRICT ACREAGE CEILING PROHIBITS THE GEOTHERMAL INDUSTRY FROM CONDUCTING A MORE AGGRESSIVE EXPLORATION AND DEVELOPMENT PROGRAM IN THIS CRITICAL AREA. THIS SITUATION IS ALSO PRESENT IN SEVERAL OTHER PROMISING WESTERN STATES. MORE CONVENTIONAL COMPETING RESOURCES, SUCH AS OIL AND GAS, ENJOY FAR GREATER FEDERAL ACREAGE LIMITATIONS THAN DOES GEOTHERMAL.

A PROVISION WHICH WOULD EXCEPT A LEASE FROM CHARGABILITY AGAINST THE ACREAGE CEILING WHEN SUCH LEASE CONTAINS A WELL SHOWN TO BE CAPABLE OF PRODUCTION IN COMMERCIAL QUANTITIES WOULD ALSO PROMOTE A MORE AGGRESSIVE EXPLORATION AND DEVELOPMENT PROGRAM FOR GEOTHERMAL RESOURCES.

SENATE BILL 883, WHICH HAS BEEN PENDING BEFORE THE SENATE ENERGY COMMITTEE FOR MANY MONTHS CONTAINS RESPONSIBLE LANGUAGE FOR CORRECTING THE PROBLEMS OF PRIMARY LEASE EXTENSIONS AND ACREAGE INCREASES. THIS LEGISLATION ALSO CONTAINS SEVERAL OTHER PROVISIONS

SUCH AS A CHANGE IN THE DEFINITION OF A KNOWN GEOTHERMAL RESOURCE AREA (KGRA). IT IS ONLY COMMON SENSE THAT A KGRA BE BASED UPON GEOLOGICAL EVIDENCE RATHER THAN ECONOMIC SPECULATION. FURTHERMORE, A LESSEE RESPONSIBLE FOR GOING INTO A FRONTIER AREA AND CONDUCTING EXPLORATION SHOULD BE ENTITLED TO THE NON-COMPETITIVE LEASE FOR WHICH HE FIRST APPLIED. WHILE WE DO NOT SEE THE NEED FOR PARKS PROTECTION LANGUAGE IN THIS PARTICULAR LEGISLATION, PHILLIPS, NONETHELESS, WOULD SUPPORT A REASONABLE PARKS PROVISION SUCH AS THAT CONTAINED IN S.883, TO ADDRESS THE YELLOWSTONE PARK-ISLAND PARK CONCERNS.

SENATE BILL 883 CONTAINS MANY OTHER BENEFICIAL PROVISIONS WHICH I HAVE NOT ATTEMPTED TO ADDRESS. PHILLIPS BELIEVES THAT THE PASSAGE OF THIS LEGISLATION WOULD PROMOTE THE FUTURE DEVELOPMENT OF GEOTHERMAL ENERGY AND WOULD PROVIDE RELIEF FOR MOST OF THE REGULATORY, ECONOMIC AND OTHER CONCERNS WHICH ARE NEEDED FROM A FEDERAL PERSPECTIVE.

AGAIN, HOWEVER, THE LEASE EXTENSION AND ACREAGE INCREASE PROVISIONS ARE TWO ITEMS NEEDED BY THE GEOTHERMAL INDUSTRY IN THE STATE OF NEVADA AND IN SURROUNDING STATES, IMMEDIATELY.

THANK YOU AGAIN, SENATOR HECHT, FOR ALLOWING US TO COMMENT ON THESE MATTERS WHICH ARE SO IMPORTANT TO THE GEOTHERMAL INDUSTRY. I WOULD BE HAPPY TO RECEIVE ANY QUESTIONS WHICH THE COMMITTEE MIGHT HAVE.

Senator HECHT. Thank you very much.

Mr. A. M. Cooper, manager, geothermal operations, Chevron Resources Co., San Francisco.

STATEMENT OF AL M. COOPER, MANAGER, GEOTHERMAL, CHEVRON RESOURCES CO., AND VICE PRESIDENT, CHEVRON GEOTHERMAL CO. OF CALIFORNIA

Mr. COOPER. Thank you, Mr. Chairman. Pardon me. I have got a little sore throat.

I appreciate the opportunity to appear before the committee to discuss the subject of geothermal development in Nevada.

In addition to being manager of Geothermal, Chevron Resources, I am also the vice president of Chevron Geothermal Co. of California.

Chevron believes that geothermal is a very important domestic resource and can play a meaningful role in meeting the Nation's energy needs in the upcoming decades.

We in Chevron further believe that market conditions primarily and legislative and regulatory impediments secondarily have delayed the timely development of the geothermal industry in Nevada.

I will try to summarize some of the major factors we think have impeded this development, the first being the Nevada market.

Sierra Pacific Power projects a relatively flat demand for electricity in Nevada, and they do not plan to invest in significant new generation capacity in the near term. It appears that in the near term any new generation facilities utilizing geothermal resources will most likely be constructed by private industry within the framework of the Public Utility Regulatory Policies Act of 1978, more commonly known as PURPA.

Such PURPA investment by private industry in geothermal development in Nevada is hampered by the price of electricity being offered by Sierra, which is too low to support significant developments.

In implementing PURPA the Nevada Public Service Commission has allowed a very narrow view of avoided costs by permitting a utility to focus on unusual opportunities for economy purchases of both coal and hydropower.

In Nevada, the small power producer is paid substantially less than the avoided costs which a utility would incur if it were to invest in new base-loaded generation capacity.

In implementing PURPA, NPSC has not taken into consideration the many indirect benefits of geothermal as a fuel. Geothermal can be developed in small increments of capacity which is of benefit to both the utility and the ratepayer. It is a clean, stable, domestic source of energy.

Also, geothermal development in Nevada would greatly benefit the local economy by providing additional employment opportunities as well as an increased revenue base. Although these indirect benefits have been acknowledged by the utility industry, the NPSC has not quantified these benefits and have not made numerical provision for these indirect benefits in the avoided-cost determination.

The low avoided cost price available to small producers coupled with a lack of demand for new generation capacity in the near term has produced a general market environment which discourages private industry investment in geothermal projects. There are numerous geothermal projects that are technologically prepared to proceed to commercial development, but these projects are being delayed by marginal economics caused by the pricing structure for electricity that I have just discussed.

The second item is transmission capability. Since the Nevada electricity price does not provide a sufficient economic return for potential geothermal developers, Chevron and others found it necessary to look elsewhere where prices are higher.

Although the published avoided costs for electricity in California are generally much higher than in Nevada, there is inadequate transmission capacity to move the electricity generated from geothermal energy to this market.

One possible solution to this transmission capacity shortage is to have nonutilities invest in the facilities; however, a nonutility developer may, by doing so, be deemed to be a public utility.

Although geothermal producers in Nevada are presently reviewing alternatives, it is not likely that geothermal producers will directly invest in transmission facilities in view of this potential for regulation.

Third, there is legislative and regulatory barriers. The basic thrust of the existing legislative and regulatory structure is to exempt qualified small power producers from the Federal Power Act and from regulation as a public utility. Under this structure, the utility industry is not provided with economic incentive to invest in geothermal power generation facilities, to purchase the electric output from such facilities or to increase transmission capacity.

Because of the development delays caused by adverse market conditions, and this has been mentioned prior, many Federal leases and Federal geothermal units are near expiration. The Nevada producers have invested significant technical effort and money to develop geothermal energy, and if they are to have the opportunity to commercialize these resources, administrative extensions to Federal leases and units by the Bureau of Land Management will be needed in many cases.

It is clear that geothermal—if the geothermal industry has become a viable element of the energy business in Nevada, there are certain things that should be considered. I would like to summarize some of these.

First, a uniform procedure should be developed by FERC to ensure that the avoided cost definitions implemented by the State regulatory bodies are consistent with the intent of PURPA.

In the case of Nevada, the avoided cost definition should include the costs of new base-loaded generation facilities and include an allowance for the indirect benefits of geothermal energy development.

Second, in view of the need to transport power to other more attractive markets, the small producers need access to existing transmission capacity. And if new transmission facilities are required, a nonutility should be allowed to construct and own such facilities without risks of regulation as a utility.

We further think that in addition, tax incentives should be made available to entities that construct these types of transmission facilities.

Third, we also feel the public utilities should receive energy tax credits for their investment in R&D and demonstration of power generation facilities which utilize geothermal energy.

Fourth, energy tax credits available for qualified geothermal property, geothermal properties are scheduled to expire on December 31, 1985, and we feel these should be extended through 1995 to provide geothermal lead time for geothermal investments.

Fifth, the primary lease terms on Federal geothermal leases should be extended 10 years to provide for needed development time. Also, the Bureau of Land Management, and this was mentioned earlier, should develop clear criteria for permitting extensions of Federal geothermal units to provide the necessary lead time for geothermal development.

I recognize that each of these proposals outlined will require extensive review and discussion in order to assess the ultimate impact on the geothermal industry and the general public. However, if we are to achieve the goal of fully developing our domestic energy resources to meet our Nation's energy needs, Chevron believes that the market for geothermal energy must be improved. Thank you.

[The prepared statement of Mr. Cooper follows:]

GEOTHERMAL DEVELOPMENT IN NEVADA's GREAT BASIN

Testimony of Al M. Cooper,
Manager, Geothermal, Chevron Resources Company
Vice President, Chevron Geothermal Company of California
Before the U. S. Senate Subcommittee on Energy and Mineral Resources,
Sparks, Nevada
April 17, 1984

I. INTRODUCTION

Mr. Chairman, I appreciate the opportunity to appear before the Committee to discuss the subject of geothermal development in Nevada's Great Basin. My name is Al M. Cooper. I am the Manager, Geothermal, for Chevron Resources Company, and Vice President of Chevron Geothermal Company of California. The Standard Oil Company of California through its operating companies has invested a significant amount of time and capital to develop geothermal resources in the State of Nevada. We believe that geothermal is an important domestic resource and can play a meaningful role in meeting the nation's future energy needs in the upcoming decades.

Chevron initiated an aggressive exploration program for geothermal energy in Nevada in the early 1970's. Over 80,000 acres of federal and fee lands comprising 15 prospects were leased during this time. Numerous hot springs were sampled and analyzed, geologic data collected, and a variety of geophysical surveys were run at many propects. Temperature and hydrogeologic information was gained through drilling approximately 300 shallow and deep wells. By late 1981, through extensive well drilling and testing, Chevron had identified the Beowawe and Soda Lake fields as having commercial electric power development potential. Unfortunately, by this time the projected need for electric power in Nevada had slackened considerably.

Accordingly, Chevron management could not justify the continuation of an extensive exploration program, and decided to focus on the development of the Beowawe and Soda Lake resources; we are still pursuing this goal today.

Chevron believes that market conditions primarily, and legislative and regulatory impediments secondarily, have delayed the timely development of the geothermal industry in Nevada. I will now summarize some of the major factors that I believe have impeded this development. You will see that the present market situation can be improved by certain legislative and regulatory changes that could expedite development so that the benefits of this clean, renewable resource can be realized in meeting our nation's energy requirements.

II. IMPEDIMENTS TO DEVELOPMENT

A. Nevada Market

Sierra Pacific Power Company (Sierra) projects a relatively flat demand for electricity in Nevada, and they do not plan to invest in significant new generation capacity in the near term. It appears that any new generation facilities utilizing geothermal resources will most likely be constructed by private industry within the framework of the Public Utility Regulatory Policies Act of 1978 (PURPA).

Such PURPA investment by private industry in geothermal development in Nevada is hampered by the price of electricity being offered by Sierra which is too low to support significant development. The current "avoided cost" proposed by Sierra is approximately one third of the cost that Sierra is actually avoiding by not building new coal fired generating facilities. In implementing PURPA the Nevada Public Service Commission (NPSC) has allowed a very narrow view of the "avoided cost" by possibly permitting a utility to focus on unusual opportunities for economy purchases of both coal and hydro power. Therefore, in Nevada, the small power producer is paid substantially less than the "avoided cost" which a utility would incur if it were to invest in base load generation capacity. Chevron feels that the better view, and one consistent with the intent of PURPA, is to calculate the "avoided cost" based on long-term base load facilities.

In implementing PURPA and the resultant calculations of "avoided cost", NPSC has not taken into consideration the many indirect benefits of geothermal as a fuel. Geothermal can be developed in small increments of capacity which is a benefit to both the utility and rate payer. It is a clean, renewable resource as well as a stable, domestic source of energy. Also, geothermal development in Nevada would greatly benefit the local economy by providing additional employment opportunities as well as an increased revenue base. Although these indirect benefits have been acknowledged by the utility industry, the NPSC has not quantified these benefits and they have not made numerical provision for these indirect benefits in the "avoided cost" determination. Recognition of these benefits through an increase of the "avoided cost" price would enhance the economics of many geothermal projects in Nevada.

The low "avoided cost" price available to small power producers coupled with a lack of demand for new generation capacity in the near term has produced a general market environment which discourages private industry investment in geothermal projects. There are numerous geothermal projects that are technologically prepared to proceed to commercial development but these projects are being delayed by marginal economics caused by the pricing structure for electricity that I have just discussed.

B. Transmission Capability

Since the Nevada electricity price does not provide a sufficient economic return to potential geothermal developers, Chevron and others have found it necessary to look to adjacent states with a higher sales price for electricity to support development. Although the published "avoided costs" for electricity in California are generally much higher than in Nevada, there is inadequate transmission capability to move the electricity generated from geothermal energy to this market. New transmission facilities require a significant capital investment and under present market and regulatory conditions Sierra has had no incentive to construct such facilities.

One possible solution to this transmission capacity shortage is to have non-utilities invest in the facilities; however, a non-utility developer who builds and owns the necessary transmission facilities may, by doing so, be deemed to be a public utility and be regulated by Federal Energy Regulatory Commission (FERC). The scope of this potential regulation tends to inhibit a non-utility solution to the lack of adequate transmission corridors out of Nevada. Although Chevron, along with other geothermal producers in Nevada, is presently reviewing alternatives available to solve this problem, it is not likely that geothermal producers will invest in transmission facilities in view of this potential for regulation.

C. Legislative/Regulatory Barriers

The basic thrust of the existing legislative and regulatory structure is to exempt qualified small power producers from the Federal Power Act and from regulation as a public utility in the appropriate state jurisdictions. Under this structure, the utility industry is not provided with an economic incentive to invest in geothermal power generation facilities, to purchase the electric output from such facilities or to increase transmission capacity.

Because of the development delays caused by adverse market conditions, many federal leases and federal geothermal units are near expiration. The Nevada producers have invested significant technical effort and money to develop geothermal energy, and if they are to have the opportunity to commercialize these resources, administrative extensions to federal leases and units by the Bureau of Land Management will be needed in many cases. If such extensions are not granted, the developers will lose their prospects, and will be obliged to pursue geothermal energy opportunities elsewhere.

III. LEGISLATIVE AND REGULATORY INCENTIVES TO ENCOURAGE GEOTHERMAL DEVELOPMENT

It is clear that changes are needed if the geothermal industry is to become a viable element of the energy business in Nevada. Based on the problems that I have briefly described above, I believe that due consideration should be given to the following proposals.

A. A uniform procedure should be developed by FERC to insure that the "avoided cost" definitions implemented by the state regulatory bodies are consistent with the intent of PURPA (e.g. a small producer should receive the highest incremental cost a utility would incur if it were to build and own new base load generation facilities). In the case of Nevada, the "avoided cost" definition should include the costs of capital installation, fuel, operation, and maintenance of new base load generation facilities, including an allowance for the indirect benefits of geothermal energy development. We believe the "avoided cost" standard adopted by the NPSC should reflect a utility's full "avoided cost" if it is to be consistent with the intent and purpose of PURPA.

B. In view of the need to transport power to more attractive electricity markets, small power producers need access to existing transmission capacity on a basis that allows expedited coordination between the interconnecting utilities. Also, if new transmission facilities are required, a non-utility should be allowed to construct and own such facilities without risk of regulation as a utility. One solution would be to include such facilities as a part of the small power producers interconnection facilities. In addition, tax incentives should be made available to entities which construct transmission facilities which are primarily dedicated to serving qualifying small power producers under PURPA.

C. Public utilities should receive energy tax credits for their investment in research and development or demonstration power generation facilities which utilize geothermal energy.

D. The energy tax credits available for qualified geothermal property are scheduled to expire on December 31, 1985 and should be extended through 1995 to provide additional lead time for geothermal investments.

E. The primary lease terms on federal geothermal leases should be extended 10 years to provide for needed development time. Also, the Bureau of Land Management should develop clear criteria for permitting extensions of federal geothermal units to provide the necessary lead time for geothermal development.

IV. CONCLUSION

I recognize that each of the proposals outlined above will require extensive review and discussion in order to assess the ultimate impact on the geothermal industry and the general public. However, if we are to achieve the goal of fully developing our domestic energy resources to meet our nation's energy needs, Chevron believes that the market for geothermal energy must be improved. The proposals outlined above, if implemented, would certainly assist the timely development of geothermal energy.

Senator HECHT. Thank you very much.

Mr. Garland Robbins, president, Sun Geothermal Co., Dallas, Tex.

STATEMENT OF GARLAND ROBBINS, PRESIDENT, SUN GEOTHERMAL CO.

Mr. ROBBINS. Mr. Chairman, I appreciate the opportunity to testify today.

Since Mr. Wright and Mr. Cooper have said most of what I had to say, I will submit our testimony for the record and just give you a few brief comments.

Senator HECHT. Thank you very much.

Mr. ROBBINS. On one of our main points. One concern we have with Sun, particularly resulting from our operations in Nevada, is the current diligence requirement in the Steam Act of 1970 requiring the contract for sale.

As a matter of history, Sun acquired the resource in Dixie Valley in 1966. We drilled our discovery well in 1978. We have now drilled a total of eight deep wells in Dixie Valley at a cost of several tens of millions of dollars.

We have been trying to market this resource since 1979 without success. Of course, this is due to the extremely low demand in Nevada and the low avoided costs that have been mentioned before. The only market we have identified is in California based on the definition of what can be offered under PURPA by the California Public Utility Commission.

The problem is it would require something over 200 miles of transmission line in order to reach the market from Dixie Valley. We don't believe that Congress intended for this to happen when they passed the Steam Act of 1970.

We would like to reiterate that Senate bill 883 contains the language to solve this problem when it would allow extension of the leases due to substantial investment and marginal economics. We would like to support and continue to support Senate bill 883.

Our concern right now is that we have been trying to do this for several years. We are somewhat concerned that Senate bill 883 might not pass in the near future. We think this issue is important enough, particularly to the people in Nevada, to address the issue of specific amendment to allow extension of leases for substantial investment and marginal economics.

We were pleased to hear that the BLM is considering some sort of administrative remedy. We think this would be very helpful.

However, we feel like permanent remedy would be required in legislation. We heartily support this approach in Senate bill 883. Thank you.

[The prepared statement of Mr. Robbins follows:]

Statement of

Garland Robbins

Mr. Chairman, my name is Garland Robbins. I am the President of the Sun Geothermal Company, a subsidiary of the Sun Company, Inc. I appreciate this opportunity to present our views on the status of geothermal development in Nevada. Sun has been active in geothermal exploration and development in Nevada for a number of years and believe that we are qualified to assess the future of this industry. Our assessment is this: we believe there is great geothermal potential in the state, but a number of major problems must be overcome for it to succeed.

There is no doubt that Nevada possesses the correct geological characteristics required for geothermal resource occurrence. It is located in the geologically active "Ring of Fire" belt. It is located in the Basin and Range physiographic province which is characterized by an abnormally high heat flow resulting from thinning of the earth's crust. Its north-south trending ridges and valleys are separated by faults which produce numerous hot springs and fumerales. In addition, at least 300 thermal wells are scattered throughout the state.

Geothermal exploration activity has been high in Nevada, which ranks second only to California in geothermal resource discoveries. At least six areas are suitable for commercial development, and the state's geothermal resource potential is estimated to be 2000-3000 megawatts. For purposes of comparison, 2000-3000 mws of generating capacity may be equal to between 8 and 12 Valmy 1-sized coal-fired power plants. In addition, Nevadans appear to support the concept of geothermal development and the climate and terrain are suitable for efficient construction operations.

The primary problem that Sun and other developers have encountered is the lack of demand for electrical energy in the vicinity of the resources. The problem of transmitting geothermal heat for long distances mandates that electrical generating facilities must be located near the producing well fields. The power generated must then be transmitted to the area where it is needed. Nevada's limited population and current lack of energy intensive industry requires the transmission of power outside the state, generally to California. Construction of high voltage power transmission lines is extremely expensive and apparently will have to be funded entirely by the geothermal developers. It should be noted, however, that even if the power moves to California, Nevada will gain a non-polluting, tax and job producing industry. In addition, one half of the federal royalties paid to the U. S. Treasury for resource production will be returned to the state.

Other problems encountered by developers reflect the nature of the geothermal resources in Nevada. It appears that the great majority and possibly all geothermal accumulation will consist of hot water rather than dry steam reservoirs such as the Geysers in California. It also appears that the larger, higher temperature resources will be found in the basins at significant depths. These conditions combine to make geothermal development costs per kilowatt hour significantly higher than an area such as the Geysers. Combining high development costs with high transmission costs makes the economic parameters of Nevada resources very tight in the present market. Although all developers feel their resources can ultimately compete with alternate fuels such as coal, the current economics make the funding of demonstration projects very difficult. This is the major reason Nevada geothermal development has not proceeded as rapidly as development in California.

This is the situation Sun has encountered in attempting to develop the resource at Dixie Valley, in Churchill County. Although we have invested several tens of millions of dollars and drilled eight deep wells, which we believe are currently capable of powering a 10 mw demonstration plant, we have been unable to negotiate a contract with the local area utility. Their stated lack of local demand along with very low "avoided cost" pricing offers has forced us to seek a market in California. Sun has been attempting, since late 1983, to devise a plan to deliver power from Dixie Valley to Southern California. We feel this is an economically viable option and presents the only alternative for development in the near future.

Sun's history in Nevada clearly illustrates a major flaw in federal law which must be corrected. Our Dixie Valley leases were obtained from the federal government in 1976, and the discovery well was drilled in 1978. We currently have six productive wells drilled and tested and have been attempting to market our resource since 1979. However, under the provisions of the Geothermal Steam Act of 1970, we will lose our leases in 1986 for failure to contract for sale of the resource as stipulated in the lease. As I stated earlier, the local area utility has no need for the power due to excess capacity and will not need the power before the

1990's. There are also no transmission interties available for wheeling power to the California market unless they are funded and constructed by the developers. Our only foreseeable alternative will be to construct over 200 miles of high voltage transmission lines and move the power to California. We do not think it was the intent of Congress to place developers in this predicament, and legislative relief should be provided.

We believe that the authors of the Geothermal Steam Act of 1970 could never have intended the situation we face in Nevada. However, although we have asked the Bureau of Land Management whether diligence requirements could be suspended on our leases and their terms extended correspondingly, to date we have received no such reassurance.

Because of the magnitude of our Dixie Valley investment, we believe it only prudent to raise this issue before the Committee in the hope that a definitive legislative solution to our problem will be found this year. Attempts have been made in several pending comprehensive geothermal bills to deal with the situation I have described. For example, Section 7 of S.883 of which you, Mr. Chairman, are a cosponsor, includes a mechanism through which the Secretary of Interior is allowed to grant lease term extensions in certain cases in which a substantial investment in developing the lease has been made, as we have in Dixie Valley. Extensions would be in order if construction of facilities to use the leases' steam has not been possible due to factors such as administrative delays or marginal economics. Also included is a provision which would require annual reporting of efforts being made to resolve whatever problems have prevented commercialization of the property. An approach similar to that in S.883 would clearly resolve the problem we are facing at Dixie Valley under our existing leases and would be sound public policy. But it appears to us that there is little prospect that a comprehensive bill will be enacted by this Congress. Let me quickly say that I would welcome any encouragement which the Senator could give with regard to these prospects.

However, in the absence of a comprehensive bill, we believe it is essential to enact at least a limited lease term extension amendment such as I have described if Nevada is to realize the full extent of, and prosper from, its abundant in-state geothermal power resources.

Senator HECHT. Thank you very much.

Our next witness is Mr. Joseph Wilson, vice president, Geothermal Division, Union Oil Co., representing Dr. Carol Otte. Now, Dr. Otte has been said to be the father of geothermal energy, and we had a nice luncheon together in Washington last week. Give him my best.

If he is the father, are you the son of it?

Mr. WILSON. I must be.

STATEMENT OF JOSEPH L. WILSON, VICE PRESIDENT AND GENERAL REPRESENTATIVE, UNION GEOTHERMAL DIVISION, UNION OIL CO. OF CALIFORNIA

Mr. WILSON. Dr. Otte is very sorry he couldn't attend today, Senator. So, I am a poor substitute.

But as you mentioned, Dr. Otte has really been one of the world leaders in geothermal energy for the last 24 years. He started our company back in the early 1960's, and since that time we have attained what we very modestly refer to ourselves as the world leader, which is evidenced by the fact that we produce over half of the world geothermal energy that is currently being produced.

My associates here have caused me to revise my statement about seven times. They have covered just about everything that we have had a concern about.

I would like to take a few moments to possibly go back a few years and the problems that we have had in getting this geothermal legislation passed. It stated back in 1979 that Jim Santini introduced a bill in congress, H.R. 740, that was a very simple bill that increased the acreage limitation from 20,480 acres to 51,200 acres.

Well, just about that time a number of studies were just being concluded. Everybody was studying geothermal since its passage in 1970. I recall the Department of Commerce, the GAO, the Department of the Interior. Other groups were studying the geothermal industry to see what was wrong, why wasn't it moving ahead a little faster.

And the concensus there were a number of restrictions in your Steam Act of 1970 that should be reconsidered. Paramount among those was the acreage limitation. Then, such other things as the KGRA definition, renegotiation of terms, and so forth.

So, it was decided, well, let's make a bill that will take care of all the problems, just not simply the acreage limitation.

Well, since that time the 96th Congress, we had a number of bills, the 97th Congress, and again in the 98th Congress, with your S. 883, which you are a cosponsor of and very familiar with.

We have been frustrated in not being able to get those things beyond committee.

One of the primary concerns has been the addition of a number of provisions in these bills that I guess people thought, my goodness, we are giving everything away to the geothermal industry, we got to do something back here. We can't just give them all these things.

So, the 10-percent set-aside to public bodies was introduced. The noncash bonus bidding.

I guess people thought that the geothermal industry was in the same category as the OCS business, which is rather ridiculous when you consider the infancy of the geothermal and the mature industry of oil and gas offshore. The parks has been another one.

I recall at one of the hearings that I was testifying at that the chief of the park service got up and was asked specifically, were current governmental laws adequate to take care of the parks and national monuments. And he said yes. Do you recall that, Bob?

But we all are realistic and we said, goodness, Old Faithful is near and dear to all of us. If you want to put a special provision on Old Faithful, go right ahead. Make it as far reaching as you want.

And other specific areas like that. But not just relating to all the parks and the national monuments with huge buffer zones around them.

Well, because of these, nothing has happened. The bills have been dying in committee.

And here we are again in the 98th Congress hoping that we can get some legislation passed. The Geothermal Steam Act provided in 15 years the Secretary could after holding public hearings increase the acreage limitation to 51,200 acres. That is next year.

So, we are almost there anyhow. When you also stop and think that the USGS has classified—oh, this was back in the 1970's—they classified 3.4 million acres as KGRA's, and over 100 million acres as areas valuable prospective, AVP, as they have been referred to.

So, our recommendation is possibly why don't we just go back to Jim Santini's old one-line bill that would simply increase the acreage limitation that everybody is in favor of, and then we can take care of these other problems in a more comprehensive bill.

One other area that has been touched on that I'd like to comment about is the tax credits. Senator Dole, chairman of the Committee on Finance, announced that his committee had agreed to extend through the end of 1988 the 15-percent renewable energy credit, the 15-percent ocean thermal credit, and the 10-percent biomass credit.

The report stated:

> A special affirmative commitment rule would extend the solar, wind, and geothermal credit through 1989 for projects on which the engineering and permitting requirements are met by the end of 1988 and the contracting requirements met by July 1, 1989.

Your support of this issue could be of great value to the geothermal industry.

As to the potential in the State, I am sure that's already been discussed adequately. The market conditions have been discussed. Everyone is aware of the problems with the marketing conditions.

As to the situation at the State and the local level, as to the regulatory groups within the State, we find little to criticize, as these agencies are performing their statutory requirements in a most efficient manner.

Thank you, Senator.

[The prepared statement of Mr. Wilson follows:]

STATEMENT OF JOSEPH L. WILSON
VICE PRESIDENT AND GENERAL REPRESENTATIVE
UNION GEOTHERMAL DIVISION
UNION OIL COMPANY OF CALIFORNIA
BEFORE THE
SENATE SUBCOMMITTEE FOR ENERGY AND MINERAL RESOURCES
OF THE SENATE ENERGY AND NATURAL RESOURCES COMMITTEE
SPARKS, NEVADA
APRIL 17, 1984

You have requested our views on what can be done at the state and local level of the government and by the private sector to encourage the accelerated development of geothermal energy in Nevada.

I would like to comment on the federal legislation concerning geothermal development that is pending in Washington. This legislation will certainly have a serious impact on the exploration and development of geothermal resources in Nevada as well as other states with geothermal potential.

You are a co-sponsor of S.833, and Union Oil has previously provided testimony at your Committee hearings. Since we all know the contents of the Bill, let me skip the details and offer our point of view on certain provisions of the bill and the delays they have caused.

As background, the Geothermal Steam Act of 1970 provided a leasing limit of 20,480 acres in any one state. It carried an additional provision that the Secretary of the Interior may increase this limit to 51,200 acres at any time after 15 years from the effective date of the Act after holding public hearings. This provision has always been completely noncontroversial, yet the legislation has been pending in the 96th and 97th Congress as well as the current session.

The delay in the passage of this legislation is one of the reasons for the slow development of geothermal resources over the past 13 years. This becomes even more apparent when one considers that the United States Geological Survey has designated 3.4 million acres as Known Geothermal Resource Areas (KGRA's) and over 100 million acres as Areas Valuable Prospectively (AVP). If the current limitation is not increased it will take an interminable time for the industry to explore and develop these lands. Another factor contributing to the delay is that the regulatory process for working on public lands has become much more complex since the 1970 enactment of the geothermal leasing bill. This slows down the ability to evaluate lands and requires a larger "inventory".

The apparent reason that this legislation has failed to move over the past 5 years is the addition of several controversial issues to the various Bills which have been introduced. For example, Section 5 of S.558, another geothermal bill under consideration by your Committee, requires the Secretary to set aside land for lease to specific groups. This 10 percent set-aside is found in the Coal Leasing Amendment Act of 1976, but the comparison of geothermal to coal leases is inappropriate. The value of coal leases can be proven relatively easily. Also, there are numerous large areas suitable for coal development.

In contrast, the heart of a geothermal resource is frequently located in a small area. Therefore, the practical effect of withdrawing such lands from development would enable public bodies to apply for "the cream" of the geothermal areas for lease. This gives public bodies an unfair competitive advantage over private sector operators. Furthermore, there is no way to determine which leases will be made available or how such leases will be identified.

This combination of factors could result in such a tremendous split of geothermal resources so as to prevent or deter commercial development.

We understand that the principle reason the rural electric cooperatives are in favor of a 10 percent set-aside is that it would require public notice prior to bidding on particular pieces of land. If this is a real concern, it can be solved in other ways.

Additional problem areas appear in both S.558 and S.883 in the form of a noncash bonus bidding provision. Such a provision would deter rather than promote the development of geothermal energy. When oil or gas is discovered, it becomes an immediate valuable asset. Returns are realized quickly and can be used to promote further capital and additional development. In the geothermal area, it takes many years between the discovery of one geothermal well and the realization of income as a result of the discovery. The drilling of numerous wells to prove the resource, and the negotiation of a sales contract with a utility may take 6 to 12 years. For these reasons, noncash bonus bidding encourages speculation rather than development in earnest. In California, where noncash bonus bidding is permitted on state lands, experience has shown that bids -- in some instances of 95 percent royalty -- are made, yet nothing has been done to develop the leases.

Another area of controversy in S.883 and S.558 is the provision to protect National Parks and Monuments. It is our considered opinion that existing environmental laws are completely adequate to protect these categories of land. We recognize that some areas, such as "Old Faithful" in Yellowstone National Park, are particularly sensitive and we support the parks language in S.883 which protects those areas. However, the provisions of S.558 are too restrictive: they give room for unnecessarily tying up large amounts of valuable acreage.

Most important, the above provisions -- not the heart of the bill itself -- have been responsible for delaying passage of the acreage limitation.

May we suggest that a simple one line Bill be introduced which merely amends Section 7 of the Geothermal Steam Act of 1970. By striking out "twenty thousand, four hundred and eighty acres, including leases acquired under provisions of Section 4 of this Act" and inserting in lieu thereof: "fifty-one thousand, two hundred acres," and striking out the second paragraph of Section 7, our goals would be accomplished and the way would be eased for geothermal development.

Another very important issue pending in Congress is the extension of the investment tax credit. The Honorable Robert J. Dole, Chairman of the Committee on Finance, announced that the Committee in a recent Executive Session agreed to the following Business Energy Tax Credits:

> "The Committee agreed to extend through the end of 1988 the 15 percent renewable energy credit, the 15 percent ocean thermal credit and the 10 percent biomass credit."

The report further stated:

> "A special affirmative commitment rule would extend the solar, wind, and geothermal credit through 1989 for projects on which the engineering and permitting requirements are met by the end of 1988 and the contracting requirements met by July 1, 1989."

Your support of this tax issue could have a very positive effect on the growth of geothermal energy.

Let me take a few minutes to discuss the potential for geothermal development in Nevada. Early drilling for geothermal resources really started in 1959 in the areas of Beowawe, Brady, Steamboat Springs and Wabuska. Exploratory drilling lapsed in 1965 and did not resume until 1974. At that time the sharp rise in the price of imported oil stimulated interest in alternate energy sources. The adoption of Federal geothermal legislation for leasing and development then created a favorable environment for geothermal exploration. The result was a renewed interest in drilling which has continued to the present.

Nevada does not have the very impressive young volcanic centers similar to Yellowstone or Mt. Lassen which clearly document the presence of anomalous heat sources necessary for geothermal development. But exploratory efforts in Nevada have provided the venturesome with enough encouragement to discuss and/or plan projects for generating power at the Beowawe, Desert Peak and Dixie Valley areas. The potential for at least moderately high temperatures, at or above 400°F, has been demonstrated in a number of other areas also.

As a result of the exploratory efforts to date the industry has established that within Nevada there are areas that have sufficient temperature to be potentially of interest for geothermal power generation. Therefore, on a geological basis, exploration is warranted. However, at present there are two inherent impediments to timely development of these resources.

First, the most promising resource areas are far removed from large electricity load centers. New transmission lines are needed to get the power to market. Local utilities hesitate to invest in new facilities or even upgrade existing lines until the technical and economic feasibility of each resource is demonstrated.

The second impediment is the prospect that geothermal electricity may not be competitive with certain other generation resources such as coal fired electricity. Local utilities are hesitant to plan geothermal power plants for their systems if such plants are not clearly the best economic alternative.

Geothermal electricity appears to be competitive in areas dependent on oil and gas generation, such as California. However, the cost of getting geothermal electricity to the California market could be very expensive unless a large, economically feasible transmission line is built.

PURPA laws and tax incentives have provided the motive for third party development of small power plants. Recently, Nevada geothermal developers proposed small power projects to market electricity in Southern California where the most favorable price exists. Nevada developers have to have a transmission line to get their product to Southern California, and it is my understanding that they are working with local utilities to provide that transmission capability.

In closing I would like to say that we consider Nevada to be one of the more progressive states in the west regarding the regulation of our industry. We find little to criticize local, state and federal regulatory agencies for, as these agencies are performing their statutory requirements in a most efficient manner. The difficulty we do have is with the provisions of the federal leasing bills that have delayed passage of the much needed acreage limitation increase.

Thank you for the opportunity to appear before your Committee.

Senator HECHT. Thank you very much, and I appreciate the fact that you were not redundant. If something had already been mentioned, there is no reason to go over it.

To all of the panel, did any of your companies intervene in the PSC's rulemaking on the calculation of avoided cost?

Mr. COOPER. Not to my knowledge.

Senator HECHT. Do you plan to do so in the future?

Mr. COOPER. We do.

Senator HECHT. You do. How effective has the Public Utility Regulatory Policies Act of 1978 [PURPA], been in assuring a market for geothermal power in Nevada? Any of you like to answer that? Yes. Mr. Robbins.

Mr. ROBBINS. I will submit a comment. I think it's been mentioned probably by Commissioner Schmidt of the Nevada PSC that the avoided costs currently on file is something around 5 cents. We have heard unofficially that Sierra Pacific has avoided cost of slightly over 3 cents now. Of course, with those figures, we'd like to point out that the people in the Geysers in California are now receiving much more than that strictly for dry steam.

We don't feel that PURPA has had any effect in Nevada because the pricing is too low. PURPA is making the market in California possible. So, that would be our comment. Maybe some of these other gentlemen have a comment.

Senator HECHT. Anybody have anything to add to that?

Mr. COOPER. I guess here again off the cuff, the way we see the PURPA being implemented in Nevada, it is substantially less than, say, California, and we think it needs to be looked at in detail, and it is too low to support geothermal development today. Maybe 10 years from now.

But we have to survive between now and then, and we really think the need for geothermal is going to be in the 1990's. If we don't start development today, we are not going to be ready for it. We need to do something today, and we think that the intent of PURPA ought to be more consistent among the States.

Senator HECHT. Of course, that is the purpose of this hearing today.

Mr. Robbins, on pages 4 and 5 of your testimony you indicate that by 1986, Sun Geothermal Co. may have to relinquish its leases in Dixie Valley due to the inability of meeting the requirements in section 6(d) of the Geothermal Steam Act of 1970.

In the absence of legislative relief, do you believe that the Secretary has the authority pursuant to section 11 of the Geothermal Steam Act to suspend your operation in the interest of conservation and thereby extend the lease term?

Mr. ROBBINS. Senator, we are not really sure that the Secretary has the authority. We have requested consideration of administrative relief because our problem is so pressing.

We also understand at least one company has also requested relief. That is why I have expressed a concern of trying to obtain some simple legislation to get a permanent solution to the problem.

However, if we can get administrative relief, we can certainly use it at this time.

Senator HECHT. Would any of the other witnesses care to comment on this?

Mr. **Cooper**. Well, I am not sure what the law says, but we feel it is very important that we are able to obtain that.

Senator **Hecht**. Talk a little bit louder.

Mr. **Cooper**. We are faced with some of the same problems of leases nearing expiration that we have been trying to develop some of our leases in the early 1970's, and we have been impeded in development because of the low market.

We feel that due diligence includes more than just fiscal or spending money. It also is trying to work our way through a market and be able to market our product and go forward.

So, we feel that there is justification for administrative extension, and we plan to have further discussions on that, like tomorrow morning.

Senator **Hecht**. You mentioned what the law is right now, so on and so forth. Of course, the number one purpose of these hearings is to determine if existing law is adequate.

Did you have something?

Mr. **Wilson**. I was going to say that I certainly concur, and I have great sympathy for particularly the folks in Dixie Valley and their engineering leases.

I am sure that Garland would feel much more confortable if there was proper legislation rather than relying on an interpretation of a provision in the act. I think it is one of the things that may have deterred exploration in your State is because of the concern if we find it, what are we going to do about it.

Our 10-year term would run, and I think that's kept a lot of people out of the business that might be searching for geothermal, and we need more competition. It is strange to hear from a developer, but we need more competition, more people drilling, more wells, more technology development.

It all benefits. It benefits all of us, industry as well as private sector.

Senator **Hecht**. Dr. Otte explained that personally to me 2 weeks ago in Washington. So, I am happy that you restated it for the record.

Mr. Wright, on pages 3 and 4 of your testimony you stress the need for increasing the State Federal acreage limitation of 22,480 acres to 51,200 acres, as provided in S. 883.

Recognizing the current lack of a market in this State and other associated problems, do you believe that the urgency for increasing the State acreage limitation is still valid?

Mr. **Wright**. Yes, Senator. To come out here and explore in Nevada or any other State, you have to set up an exploration department and a staff, and it is going to be a business. Once you get it set up, you find one prospect, you have got to keep going.

It takes almost 6 years to locate and evaluate a prospect, and then it takes another 5 years to permit and build a powerplant.

So, we are almost too late to start, and with the acreage limitation and just one prospect for just enough acreage for one prospect, it just puts you out of business.

We have a particular situation in the State of Nevada. We have an option from Southern Pacific Railroad on a lot of fee land. It is not subject to the Federal limitation, but we can't explore that because it is checkerboarded with Federal land, and we can't—if we got a discovery on it, we'd make the Federal land KGRA's and have to go to a sale against our competitors.

Senator HECHT. Thank you. Would any other witnesses care to comment.

Before we proceed with the next panel of developers, I want to again mention that the committee welcomes additional testimony from people not on today's witness list. And despite our best efforts, some people did not become aware of this hearing until very recently. We put out a press release over 3 weeks ago, but many of our local papers didn't run it until last week.

Now, we are moving right along, and in order to accommodate all of you which came from long distances by air and whatever, and by car, and having come out of the business world for 35 years before just becoming a Senator, it is my intention to have a break right now for 10 minutes, and then to continue on until we finish. We will be in recess for 10 minutes.

[A recess was taken.]

Senator HECHT. We will now proceed with panel No. 4. Would they please come up?

We will start with Mr. Larry Krumland, manager of geothermal programs, Gibbs and Hill, Inc., San Jose, Calif. Mr. Krumland.

STATEMENT OF LARRY R. KRUMLAND, MANAGER, GEOTHERMAL PROGRAM AND DEVELOPMENT, GIBBS & HILL, INC., WESTERN REGIONAL OFFICE

Mr. KRUMLAND. Thank you, Senator Hecht. Appreciate the invitation to be here.

We have had some good discussions on the geothermal development in northern Nevada from the resource developers' point of view, and I think I will skip any of the discussions on the avoided cost, transmission availability. I think that's been well covered.

Our firm is primarily interested in the development of the powerplants. Our parent corporation, Dravo, is going to own and operate a project in southern California. So, we are interested in that part of the business in addition to our original engineering services.

Right now we have projects going in the Geysers, Utah, Imperial Valley, and studies in other parts of the world.

Gibbs and Hill is convinced that geothermal energy is a technically viable and economic resource, and we believe that nothern Nevada offers exceptional geothermal development opportunities. Over the long term the United States must develop all of its domestic energy resources, including coal, oil, gas, nuclear, geothermal, wind, solar, hydro, waste heat, and municipal solid wastes. All of these resources have certain benefits and limitations, and each will be developed at a rate that depends on its relative economic, environmental, and public acceptability factors.

And we have talked about some of these, but I think a couple of significant advantages of geothermal, say, versus some of the other alternative energies is, first of all, it is available 24 hours a day, and therefore, suitable for base-load electrical generation.

Even more important, it has a proven track record. To date there are over 1,400 megawatts on line and another 700 megawatts should come on line before 1989. The replacement value of the current investment in wells and powerplants is approaching $3 billion in 1984 dollars. So, it is a resource that has proven itself and shouldn't scare people off from that standpoint.

Northern Nevada being one of the prime geothermal areas with extensive proven resources, we are sorry to see that development hasn't forward faster. We have in the past years been involved in studies, evaluations, and proposals for geothermal projects at Dixie Valley, Big Smokey Valley, Beowawe, and Fallon. All of these projects appear to still be at least 2 years from completion or operation.

I think I will jump over and talk about some of the issues. We have looked at the impact of various construction, ownership, and financing issues on the rate of geothermal development in Nevada and elsewhere. We feel that certain approaches can improve project economics, increase the availability of financing sources, and shorten construction times.

The economics of a geothermal project depend on the price received for the steam or electricity sold; the capital investment in the wells, brine gathering and injection systems, and the powerplant; and the time it takes to get the project into commercial operation. The project economics are significantly improved if the electricity can be sold for its true replacement value, since geothermal can compete with new coal-, oil-, or gas-fired plants.

In the area of construction, the use of modular, standardized design generating units can improve project economics in the following ways:

No. 1, modular plants are currently available in standard designs in the 5- to 15-megawatt size and can be delivered in 12 to 15 months. The overall project can be on line in less than 2 years.

Even though the cost per kilowatt of a small project generally is higher than the unit cost of a bigger project, the smaller unit using a standardized design can save costs of engineering, field construction, and interest during construction.

Third, the financial risk is minimized by the smaller absolute investment and the shorter construction time. Also, major portions of a modular plant can be relocated to a new resource if the resource should be depleted earlier than originally planned.

Fourth, the use of standardized designs proven elsewhere usually allows the suppliers to offer better warranties on their equipment. A modular system can be tested more completely in the factory before being shipped to the site, and repairs can be made at less cost while still in the factory.

Among the primary options available for a geothermal project are the following:

No. 1, the utility owns, operates, and finances the powerplant. A private developer owns, finances, and operates the geothermal resource supply system. The utility purchases fluids from the developer under a long-term contract.

And that is typical of the project at the Geysers between, say, Union, Natomas, and PG&E.

Second approach is for a private investor to own the powerplant and buy geothermal fluids from a private developer. The power is sold to the local utility.

An example would be the project that we are going to be in with Chevron at Heber in southern California.

Last, a joint venture or single entity owns the plant and geothermal resource. The venture sells power to the local utility.

The only example I can think of right now is the Occidental project at the Geysers.

All of these approaches are being used in current geothermal projects. All have relative advantages and disadvantages regarding contractual arrangements, use of tax benefits, and day-to-day operation. It is not possible to state that anyone is preferable in all cases to any other one.

A new source area such as the one in northern Nevada may have a high perceived risk. And therefore, a local utility is going to probably be hesitant to proceed because of its regulated status. In this case, the private investment community will have to make the necessary investment and bear the risks if development is to proceed.

However, the incentive to assume the risk has to be provided in the way of long-term electricity purchase contracts at reasonable prices based on replacement costs and on favorable tax treatment of the project capital expenditures and operating income.

As with almost all capital investment projects, the ownership and financing structure is heavily dependent on the tax benefits available and on the legal and tax treatment of the ownership organization.

Sources of debt and equity financing for geothermal projects include the plant owner, operator, power purchaser, equipment suppliers, engineering and construction companies, insurance companies, banks, and leasing organizations.

Very often the organizations with the experience and skills to develop and operate the projects are not necessarily the ones that can use the tax benefits.

On the other hand, there are financial institutions and other organizations that want to invest in energy development and that can make the required financial investment and use the available tax benefits. However, these projects have to offer the potential of after-tax, risk-adjusted rates of return that are competitive with other investment opportunities.

It is in these areas that the U.S. Government can help promote the development of these new energy resources by continuing to offer the necessary investment and energy tax credits, accelerated recovery of investment, and the transfer of benefits through tax-oriented leasing arrangements.

The alternative energy industry favors the extension of the current business energy tax credit beyond its December 31, 1985, expiration date. We supported the various House and Senate bills introduced in the first session of the current Congress. These would have extended the credit through 1990 and increased it from 15 to 25 percent.

However, we are aware of the need to reduce the projected Federal budget deficits. And therefore, the recent 1985 tax bill reported out by the Senate Finance Committee extending the credits through 1988 is probably a reasonable compromise and should be an incentive for investors to proceed with new geothermal projects.

The availability of intangible drilling cost expensing, 5-year ACRS cost recovery, and geothermal depletion allowances are important factors in keeping geothermal development moving forward.

The expiration of the safe-harbor leasing provisions generally will make it more difficult to develop ownership structures that can effectively utilize the tax benefits necessary to increase the utilization of new, higher risk energy technology. Also, the proposed restrictions on the use of tax benefits by private developers for energy projects used by or benefiting local government agencies will be a constraint on new development by these agencies. I think that is something that's received some consideration.

In summary, the factors which we feel would help accelerate geothermal development in northern Nevada include the following:

First, avoided costs which include the replacement capacity cost of coal plants as well as the cost of coal energy.

Second, transmission links to the California electric load centers that will continue to burn extensive quantities of gas and oil.

Third, the use of modular, standardized design plants to reduce development costs, schedules, and financial risk, thereby attracting a greater number of investors.

Fourth, the extension of the business energy tax credit through at least 1988 and longer, if possible, to help offset some of the initial investment and provide competitive financial returns.

Fifth, demonstration projects receiving higher than current avoided-cost payments, such as those that Sierra Pacific Power Co. is currently assessing.

[The prepared statement of Mr. Krumland follows:]

Statement of

Larry R. Krumland
Gibbs & Hill, Inc.
Western Regional Office
San Jose, California

My name is Larry R. Krumland. I am Manager of Geothermal Program Development and Planning for Gibbs & Hill, Inc., Western Regional Office, San Jose, California. For the past four years I have been involved in Gibbs & Hill's diverse geothermal activities. For eight years prior to that I worked for Pacific Gas & Electric Company in the development of its geothermal energy projects. My formal education is in engineering, business economics, and finance.

Presently, Gibbs & Hill and its sister company, Dravo Constructors, Inc., are providing engineering and/or construction management services for geothermal projects that include hot water and dry steam resources, and binary, single- and dual-flash technologies. These projects include the following:

- Northern California Power Agency, two 55 MW units, The Geysers, California
- Heber Geothermal Company, 48 MW dual-flash unit, Heber, California
- Utah Power and Light Company, 20 MW single-flash Milford Project, Roosevelt Hot Springs, Utah
- MCR Geothermal Corp., Francisco Project steam stacking hydrogen sulfide abatement system, The Geysers, California
- San Diego Gas & Electric Company, 45 MW Heber Binary Geothermal Project, Heber, California

Dravo Corporation, Gibbs & Hill's parent company, will be a co-owner of the Heber Geothermal Company dual-flash plant and will act as operator during the 30-year life of this project. It is planned that additional units will be installed at the Heber plant site following successful operation of the inital unit.

Gibbs & Hill is convinced that geothermal energy is a technically viable and economic resource and is actively pursuing service and investment opportunities in this industry. We believe that northern Nevada offers exceptional geothermal development opportunities and, therefore, we appreciate the chance to participate in these hearings.

We believe that over the long term, the U.S. must develop all of its domestic energy resources including coal, oil, gas, nuclear, geothermal, wind, solar, hydro, waste heat, and municipal solid wastes. All of these resources have certain benefits and limit ations, and each will be developed at a rate that depends on its relative economic, environmental, and public acceptability factors. Geothermal energy has certain unique characteristics that make it a preferred energy resource at this time and for the foreseeable future. Some of these advantages are as follows:

- Geothermal energy is an indigenous resource, with extensive occurrence in the western U.S. and virtually no potential for embargoes or boycotts.
- It is available 24 hours per day and is, therefore, suitable for base-load electrical generation.
- It has a proven track record. Over 1,400 MW are on-line at present, and another 700 MW should come on-line before 1989. Replacement value of the current investment in wells and power plants is approaching $3 billion (1984$).
- The optimum economic project size is in the range of 50 to 100 MW, and therefore individual engineering, construction, and financial requirements are not unduly burdensome.
- With slower electrical load growth, the optimum economic project size will be closer to the optimum utility resource addition size.
- The energy resource is fairly concentrated relative to diffuse energy sources such as solar and wind.
- It utilizes currently-available technology and low operating temperatures and pressures, resulting in relatively safe and reliable systems.
- Air, water, and surface environmental impacts are relatively minor compared to fossil fuel emissions and large scale mining impacts.

Northern Nevada is one of the prime areas with proven, extensive geothermal resources. Unfortunately, to date the development of these resources has been slow. Over the past several years, our firm has been involved in studies, evaluations, and proposals for geothermal projects at Dixie Valley, Big Smokey Valley, Beowawe, and Fallon. All of these projects appear to be at least two years from commercial operation.

We are pleased to see Sierra Pacific Power Company's recent efforts to further geothermal development by signing power purchase contracts with three developers. By paying higher than current avoided cost for this power, subject to regulatory approval, SPP Co. will allow initial development of these resources to begin.

Before large-scale development can proceed, we see two primary issues that must be resolved. First, the current avoided cost of power in the northern Nevada area is based on burning coal in existing power plants, or on buying surplus hydro power from the Pacific Northwest. A new geothermal plant utilizing a hot water resource generally cannot produce power competitively with power from an existing coal plant with a low book value and depreciation expense. However, on a long-term basis geothermal can be very competitive with new coal-fired power plants. Therefore, when the offered avoided cost begins to include replacement (versus historical) capacity cost of new coal plants, we believe geothermal development will accelerate.

The second primary issue is transmission availability. For significant geothermal development to occur in northern Nevada, new transmission interconnections to the primary California electric load centers will be necessary. Benefits to Nevada from exporting power include increased local employment, increased local property taxes and state sales taxes, electrical wheeling charges, and a developed base for the state's own future electrical generation requirements.

Currently, SPP Co., Southern California Edison Company, and several geothermal developers are discussing a transmission interconnection to Southern California. This type of project should be supported and encouraged by local, state, and federal government agencies by minimizing the regulatory requirements imposed on the project and by helping to choose an appropriate transmission corridor. A similar project is being considered to help transmit power to northern California within the next three to four years. The near-term access to 200 MW of transmission capability would allow development of several resource areas to begin simultaneously.

In addition to the avoided cost and transmission issues, Gibbs & Hill has investigated the impact of various construction, ownership, and financing issues on the rate of geothermal development in Nevada or anywhere else. We feel that certain approaches can improve project economics, increase the availability of financing sources, and shorten construction times.

The economics of a geothermal project depend on the price received for the steam or electricity sold; the capital investment in the wells, brine gathering and injection systems, and the power plant; and the time it takes to get the project into commercial operation. The project economics are significantly improved if the electricity can be sold for its true replacement value, since geothermal can compete with new coal, oil- or gas-fired plants.

In the area of construction, we feel the use of modular, standardized design generating units can improve project economics in the following ways:

- Modular plants are currently available in standard designs in the 5 to 15 MW size and can be delivered in 12 to 15 months. The overall project can be on-line in less than two years.

- Even though the cost per kilowatt of a small project generally is higher than the unit cost of a bigger project, the smaller units using a standardized design can save costs of engineering, field construction, and interest during construction.

- The financial risk is minimized by the smaller absolute investment and the shorter construction time. Also, major portions of a modular plant can be relocated to a new resource if the resource should be depleted earlier than originally planned.

- The use of standardized designs proven elsewhere usually allows the suppliers to offer better warranties on their equipment. Also, a modular system can be tested more completely in the factory before being shipped to the site. Repairs can be made at less cost while still in the factory.

- Skill requirements of local construction labor personnel are not as stringent and the modular design requires less installation time. This is especially important where various craft skills are not immediately available or weather is a factor.

Among the primary ownership and financing options available for a geothermal project are the following:

- The utility owns, operates, and finances the power plant. A private developer owns, finances, and operates the geothermal resource supply system. The utility purchases fluids from the developer under a long-term contract.

- A private investor owns the power plant and buys geothermal fluid from a private developer. Power is sold to the local utility.

- A joint venture or single entity owns the plant and geothermal resource. The venture sells power to the local utility.

All of these approaches are being utilized on current geothermal projects. All have relative advantages and disadvantages regarding contractual arrangements, use of tax benefits, and day-to-day operation. It is not possible to state that any one is preferrable in all cases to any other one.

Examples of the first ownership and operation approach are the Pacific Gas and Electric Company/Union-Natomas projects at The Geysers. The Dravo/Chevron and Parsons/Republic Geothermal, Inc., projects in the Imperial Valley are examples of the second ownership approach. The Occidental project at The Geyers is an example of a single entity developing both the geothermal resource and power plant.

A new resource area such as the one in northern Nevada may have a high perceived risk. Therefore, a local utility might be hesitant to proceed because of its regulated status. In this case, the private investment community will have to make the necessary investment and bear the risks if development is to proceed. However, the incentive to assume this risk has to be provided in the way of long-term electricity purchase contracts at resonable prices based on replacement costs and in favorable tax treatment of the project capital expenditures and operating income.

As with almost all capital investment projects, the ownership and financing structure is heavily dependent on the tax benefits available and on the legal and tax treatment of the ownership organization.

Sources of debt and equity financing for geothermal projects include the plant owner, operator, power purchaser, equipment suppliers, engineering and construction companies, insurance companies, banks, and leasing organizations.

Very often the organizations with the experience and skills to develop and operate the projects are not necessarily the ones that can use the tax benefits. One the other hand, there are financial institutions and other organizations that want to invest in energy development and that can make the required financial investment and use the available tax benefits. However, these projects have to offer the potential of after-tax, risk-adjusted rates of return that are competitive with other investment opportunities.

It is in these areas the U.S. government can help promote the development of these new energy resources by continuing to offer the necessary investment and energy tax credits, accelerated recovery of investment, and the transfer of benefits through tax-oriented leasing arrangements.

The alternative energy industry favors the extension of the current business energy tax credit beyond its December 31, 1985 expiration date. We supported the various House and Senate bills introduced in the first session of the current Congress. These would have extended the credit through 1990 and increased it from 15 to 25 percent. However, we are aware of the need to reduce the projected federal budget deficits. Therefore, the recent 1985 Tax Bill approved by the Senate Finance Committee extending the credits through 1988 is probably a reasonable compromise and should be an incentive for investors to proceed with new geothermal projects.

The availability of intangible drilling cost expensing, five-year ACRS cost recovery, and geothermal depletion allowances are important factors in keeping geothermal development moving forward. The expiration of the Safe-Harbor Leasing provisions generally will make it more difficult to develop ownership structures that can effectively utilize the tax benefits necessary to increase the utilization of new, higher risk energy technology. Also, the proposed restrictions on the use of tax benefits by private developers for energy projects used by or benefitting local governmental agencies will be a constraint on new development by these agencies.

In summary, the factors which we feel will help accelerate geothermal development in northern Nevada include the following:

- Offered avoided costs which include the replacement capacity cost of coal plants as well as the cost of coal energy
- Transmission links to the California electric load centers that will continue to utilize extensive quantities of gas and oil fossil fuels
- The use of modular, standardized design plants to reduce development costs, schedules, and financial risk, thereby attracting a greater number of investors
- The extension of the business energy tax credit through at least 1988 and longer, if possible, to help offset some of the inital investment risk and provide competitive financial returns
- Demonstration projects with higher than current avoided cost payments such as those that Sierra Pacific Power Company is currently assessing

Senator HECHT. Thank you very much.

Our next witness, Dr. Tsvi Meidav, president, Trans-Pacific Geothermal Corp., from Oakland, Calif.

STATEMENT OF DR. TSVI MEIDAV, PRESIDENT, TRANS-PACIFIC GEOTHERMAL, INC.

Dr. MEIDAV. My name is Tsvi Meidav, and I have been involved in geothermal exploration and development for the past 17 years, both domestic and internationally.

What I came here to discuss is specifically the energy tax credit and its impact on Nevada geothermal development. I would like to develop a model which shows the extension of the energy tax credits due to expire by December 31, 1985, would result in a fairly quick recovery to the U.S. Treasury of all that has been invested in it, and would have a very significant impact on the development of Nevada, in particular.

I am not going to repeat what some of my eminent colleagues have already discussed, and instead, go immediately to the bottom line, and that is the impact of the energy tax credit.

In the model that I have developed, which has been submitted to you, I propose that industry would develop somewhere around 400 megawatts in northern Nevada given the extension of the energy tax credit. And if extended from 1990 to the year 2,000, its very reasonable to assume that another 1,600 megawatts or a total of 2,000 would be developed by the year 2000.

In my estimation, supported by that of some of my colleagues in the U.S. Geological Survey and others, the ultimate potential of northern Nevada amounts to somewhere between 2,000 to 5,000 megawatts.

Let's see what the impact of these are both negatively on the Treasury, assuming that tax credit is extended to 1990, and let's evaluate it with the benefits.

Assuming development of 400 megawatts at the approximate cost of $2,000 per kilowatt capacity, by the year 1990, it would amount, the extension of the energy tax credit would amount to a Federal subsidy of about $120 million to the developer companies.

In return, I have shown—I will not go through the details of it—that through the combination of the royalty, Federal royalty on steam, which would amount to $10 million a year, Federal income tax on pretax income, another $16 million, on the 400 megawatt, first 400 megawatts that would be developed, which I believe are fully developable by 1990, there will be a revenue back to the Federal Government on the order of $80 million a year, from the moment that these plants are on line.

However, it is very reasonable to assume that once the risk has been taken out of geothermal development, at some point in time industry would consider it, and utilities as well, would consider it to be a nonrisk operation where they would be willing to proceed onward without additional Federal subsidy in the form of energy tax credit, and assuming that we indeed develop another 1,600 megawatts in the 1990 decade, we are talking about a total Federal recovery in form of income, taxes of different types, of about $380 million a year.

Now, in addition to that development, we are talking also about some other impacts, such as the savings in foreign currency of imported oil. Every barrel of oil that is imported provides approximately 640 kilowatt hours of electricity.

Therefore, if we develop something like 2,000 megawatts by the year 2000, in northern Nevada, we are going to save approximately half a billion dollars a year in fuel oil that is not imported from abroad. Then, let's multiply it by whatever we will have in the Western United States, not confining our review to Nevada alone, the Electric Power Research Institutes estimates that it is entirely feasible that a total of 10,000 megawatts geothermal would be developed in the Western United States by the year 2000, amounting to approximately $2½ billion a year in savings in fossil fuel, and that is in oil, not imported, due go geothermal.

I would like to conclude by giving an example of a specific company from our own experience. Our company has recently drilled a couple of wells in Dixie Valley, NV. We now have shut in geothermal energy of about 12, 13 megawatts. We would like to put a powerplant on line in 1985 or 1986, increase it hopefully to double that quantity by 1987 or 1988, and bring it up to maybe 80 megawatts by 1990.

However, we are going to the financial community in order to get the necessary equity capital to do that, and one of the questions that they have repeatedly asked is what is the rate of return now in this high-risk project, and therefore, are we certain that this is a feasible investment as compared to other investments.

The response to that, indeed, in what I have said earlier, and that is that having demonstrated the profitability of the operation, we would be then in the position to be able to carry on after some initial modest development without the support of the credit.

So, our recommendation to you, sir, and to Congress in general, to do the best that you can in extending the energy tax credit to beyond the date.

[The prepared statement of Dr. Meidav follows:]

IMPACT OF THE FEDERAL ENERGY TAX CREDIT ON NEVADA'S FUTURE

Dr. Tsvi Meidav, President
Trans-Pacific Geothermal, Inc.
Oakland, California

Summary

Geothermal energy is an abundantly available resource in the Western United States. Nevada possesses a potential of up to 5000 megawatts of electrical power from geothermal resources. Yet, the total installed capacity in the United States is less than 1500 megawatts at this time, and not a single geothermal plant has been constructed in Nevada to date. The reason for the slowness of development of this indigenous resource lies in the cheapness and abundance of oil before 1973, and excessive construction of power plants, compared with need, after 1973. The glut in fossil fuel and nuclear power capacity may last until about 1988. Hence, the Energy Tax Credit, which was created to stimulate investment in geothermal energy and other renewable sources of electricity, was hardly used until now. Its most beneficial impact would be now and in the next few years, when the need for new power generating capacity is required. The Energy Tax Credit would increase the attractiveness of investment in an inherently high-risk new source of energy. It is recommended that the Energy Tax Credit for geothermal energy be extended to 1990.

If the Energy Tax Credit is extended, it is anticipated that 400 megawatts of geothermal power would be constructed in Nevada by 1990, and an additional 1600 megawatts, without the credit, by 2000.

The initial loss to the United States Treasury of $120 million due to the tax credits extended for the construction of 400 megawatts of geothermal power in Nevada, will be subsequently offset by the following gains:

1. About $80 million annually in federal revenue from royalty on steam, income tax on profits and the economic multiplier effects of the first 400 megawatts.

2. About $380 million annually in all of the above categories, when the installed capacity reaches 2000 megawatts.

3. About $42 million dollars per year will be gained by the State of Nevada and Nevada counties from property and sales taxes, and from payment to Nevada of one-half the federal royalty on steam which the private companies will pay the Bureau of Land Management.

4. Reduction of payments to foreign countries of about $2.5 billion per year (in 1984 dollars) will be realized by the production of 2000 megawatts of geothermal power will displace about 4,375,000 barrels of imported oil annually. United States dependence on foreign energy sources is reduced correspondingly.

Introduction

Earth scientists in industry and federal agencies estimate that Nevada possesses a geothermal energy potential in the range of 2000 to 5000 megawatts. Right now, the shut-in geothermal energy in commercial wells already drilled in Nevada has the potential for generating more than 50 megawatts from electrical power plants. If the clearly indicated, yet undeveloped potential of geothermal energy of Nevada is to be developed to a point where it has a significant impact on the local and national economy, a myriad of problems must be solved. Some of these solutions require federal and local support.

To encourage the development of renewable energy sources and to reduce dependence on imported oil, the federal government instituted some years ago the Energy Tax Credit. In the case of geothermal energy, that Energy Tax Credit amounts to 15%, over and above the normal Investment Tax Credit. The Energy Tax Credit is a form of a federal subsidy which aims at encouraging private industry to invest in a new, inherently risky business activity, with the intent that once the renewable energy industry has matured, such an incentive would no longer be necessary. For that reason, a "sunset date" at which time the energy tax credit will be terminated has been set by Congress. In the case of geothermal energy, the Energy Tax Credit will expire on December 31, 1985.

The following presentation demonstrates the beneficial impacts of the tax credit on the development of the geothermal industry in Nevada. In addition, it shows that this development will be accompanied by a significant increase in both State and Federal revenues. In conclusion, it shows that a five-year extension of the Energy Tax Credit to December 31, 1990 is desirable for deriving the maximum benefits from Nevada's geothermal resources for developers and for the State and Federal governments alike.

Advantages of Geothermal Energy

The chief advantages of geothermal energy may be summarized as follows:

1. Geothermal is an indigenous source of energy, widely available in many western states. Any power plant using geothermal energy displaces another one using imported oil. (There are several thousand megawatts of oil and gas power plants in California.)

2. On a long-term levelized cost basis, geothermal energy is cheaper than any fossil fuel. However, much like hydro, where the high initial capital cost makes it expensive in the early years, the largest cost item in geothermal energy production is the cost of exploration and development of the steam field and the capital cost of electrical facilities. However fuel costs are eliminated needed for operation, and the other operating and maintenance costs have been proven to be very low compared to generation by fossil fuel combustion. Thus, in the long run, geothermal energy becomes a much less expensive energy source.

3. Geothermal energy is amenable to small scale development by units. This reduces local resistance to giant power plants, and eliminates the apparent financial advantage of one large plant over several smaller plants, as is the case with nuclear, oil and coal plants. The latter are much more sensitive to economics of scale.

4. Geothermal energy generates federal and local revenues in the form of royalties on the heat energy produced.

5. Because of the smaller size of individual geothermal plants, large construction crews with the accompanying boom and bust impacts on local economies are avoided. On the other hand, long-term, stable employment opportunities are provided which are easily filled by the local communities.

6. Development of a domestic energy source generates federal, state and local taxes far more than any imported energy.

7. Geothermal energy development reduces the hazard of acid rain and other environmental and safety risks associated with fossil and nuclear power plants.

Reasons for Slowness of Geothermal Energy Development in the United States

If it is so good, some skeptics may ask, why has geothermal energy failed to develop any faster in the United States? The answer to this question lies in a number of factors:

1. Until 1970, when the federal government finally issued the Geothermal Steam Act, it was impossible to lease federal land for geothermal exploration. Yet, most of the known geothemal resources in the United States, and in Nevada, are under federal land. In The Geysers and Imperial Valley geothermal fields of California, where abundant private land with geothermal potential exists, nearly 1500 megawatts of geothermal electricity have already been developed.

2. In the pre-1973 era, when oil costs were less than $3.00 per barrel, electric utilities were most reluctant to try innovative sources of energy. Geothermal energy, due to the large initial investment in high risk exploration was almost ignored.

3. The quantum jumps in the price of oil from 1973 through 1979 increased the cost of electricity to consumers very significantly, thus, reducing the rate of growth of demand for electricity. Yet, construction of fossil and commitment to nuclear plants continued unabated for several years. The recession of 1979 to 1983 further compounded the problem of excess electrical power plant capacity. Due to this environment, renewable energy power plants, geothermal plants amongst them, became a nuisance that most utilities did not wish to

deal with. Were it not for the PURPA 1978 and some conscientious public utility commissions (such as the California PUC), practically no renewable energy would have been placed on line in the post-1973 era. The negative growth rate for new power sources in the post-1973 era resulted in resistance by most utilities to offers by private companies to develop geothermal electricity.

Were it not for the saturated electrical market and the depressed economy, geothermal energy would have developed much more rapidly. Paradoxically, the Energy Tax Credit has hardly been utilized hitherto because of the glut in electricity; yet it may disappear by the end of 1985, when its most positive impact would otherwise begin, and the intent of Congress in its previous enactment would become a reality.

Analysis of the electrical utility capacity needs in the Western United States shows that by 1988 most of the Western utilities will have placed all of the current excess capacity into use. After 1988, major new additions will be needed, even for the most conservative scenarios of electrical demand growth. It is in that time frame, 1988 and beyond, that geothermal electricity could provide its most valuable contribution to the electrical energy needs of the West, while also developing new sources of employment, taxes and industrial growth.

Cost/Benefit Analysis of the Energy Tax Credit

Opponents of the geothermal Energy Tax Credit denounce it as contributory to the federal budget deficit. This is not so. The Geothermal Energy Tax Credit should be viewed as a short-range revenue reduction with eventual benefits to the national and local economy which far outweigh the small initial subsidy.

In the following table regarding geothermal development, it is assumed that geothermal energy in Nevada, if stimulated by the extension of the Energy Tax Credit will reach a capacity of about 400 megawatts. It is further assumed that the success of the initial 400 megawatts will encourage utilities and private investors to add another 1600 megawatts. The latter may be added without any special incentive or tax credit, since the percaived risk will be diminished by actual experience with geothermal power in Nevada by that time.

The loss in taxes to the federal government from the extension of the 15% tax credit, as applied to 400 MW of geothermal facilities is $120 million, assuming an investment of $2000 per kilowatt installed capacity.

The gains to the economy may be divided among royalty on steam produced, federal corporate income tax, salary income tax and the multiplier effect on salaried income.

FEDERAL TAX BENEFITS FROM GEOTHERMAL DEVELOPMENT IN NEVADA

First 400 Megawatts, 1986-1990 - With Tax Credit

Federal royalty on geothermal steam, 10% of $100 million/yr	$ 10.0 mil/yr
Federal income tax on net pretax income, 46% of $130 million/yr	60.0
Federal income tax on 200 new employees, $36k/yr, 30% tax bracket	2.2
Federal income tax on economic multiplier (x3)	6.6
Total 400 MW federal benefit per year	$ 78.8 mil/yr

Additional 1600 Megawatts, 1991-2000, Without Tax Credit

Federal royalty addition	$ 40.0 mil/yr
Federal income tax on revenue	240.0
Federal income tax on salaried employees	4.4
Economic multiplier effect (x3)	13.2
Total, 1600 MW federal benefit per year	$297.6 mil/yr
TOTAL FEDERAL BENEFIT, 2000 MEGAWATTS	$376.4 mil/yr

Benefit to the State and to the Counties Involved

Development of 2000 megawatts will result in an annual Nevada property tax of about $11 million per year. The federal government will pay to the State of Nevada one-half of the federal royalty on the steam energy. This amounts to $25 million per year for a 2000 megawatt development. In addition, the counties where geothermal energy is produced may be the prime beneficiaries of the federal royalty rebate, as is the case in California.

A 2000 megawatt plant capacity, operating at an 80% load factor, and priced at eight cents per kilowatt-hour (1985 prices) will generate a gross revenue of about $1.1 billion per year. Assuming a 20% net and a sales tax (in Nevada) of 1.3% of net, the sales tax on the geothermal power by the year 2000 will be about $3 million per year (in 1985 dollars).

Other benefits to the state and county may come from tax payments by the service industries involved. For example, the drilling and completion of wells for 2000 MW capacity will cost about $1 billion, all carried out by United States firms. These companies will pay various state and local taxes for the services that they render. Construction and purchase of the geothermal power plants will cost about $3 billion, which would generate additional tax revenues. All above amounts are based on prices in 1985 dollars.

Benefit in Foreign Exchange Savings

A 400 megawatt geothermal capacity operating at 80% load factor displaces 4,375,000 barrels of oil. Assuming a price of $28/barrel, the reduction in oil imports amounts to $122 million per year. When increased to 2000 megawatts, the geothermal production will save the country some $490 million per year. The Electric Power Research Institute (EPRI) estimated in 1983 that, at current growth rates, geothermal energy capacity will grow to about 10,000 megawatts on a country-wide basis by the year 2000, amounting to about $2.5 billion per year by 2000. All of these benefits will continue growing in importance past the year 2000, as the additional resources are continuously developed. Also, reduction of dependence on foreign energy importation remains a national objective.

Importance of the Energy Tax Credit

Without the small, modular geothermal power plants which are now being seriously considered right now in various parts of northern Nevada, there will be none of the larger developments which are anticipated for the 1990's and beyond. The electric utilities are reluctant to install any of the geothermal power plants at their own cost. This is due to both the power surplus which most are currently experiencing, as well as the hesitation to engage in any high-risk power project. In the past, utilities have been heavily penalized by public utility commissions for delays or failures to complete any new project. To electric utilities, new geothermal power development possesses many risk elements and no visible immediate benefits. Private investors are prepared to take that role, provided that the rate of return on the early pilot plants is sufficiently high to reward them for the risk which they have undertaken. The Energy Tax Credit provides such an incentive. The experience of one company will illustrate the situation of many geothermal operators in Nevada. We plan to put a 12 megawatt geothermal power plant on stream in Dixie Valley, Nevada, in 1986, utilizing the geothermal energy that we have already discovered. We hope to bring that capacity up to 25 megawatts by 1988, and to 80 megawatts by 1990. The financing of our projects is greatly affected by the perception within the investment community of the reward associated with our inherently risky project. We are assured that we will have the equity investment in our enterprise if the Energy Tax Credit is still in effect. At the same time, the cloud hanging over the issue of extension of that credit has already scared away many potential investors. Thus, the implementation of our plans may be severely hampered by the elimination of the tax credit. This example may be multiplied many fold when applied to other independent energy producers. The losses to the United States economy, in particular to Nevada, from the elimination of the Energy Tax Credit will far outweigh any short-term gains to the treasury.

Senator HECHT. Having been in banking for 20 years, I can understand some of the idiotic questions bankers ask about getting repaid.

Mr. Steve Munson, Munson Geothermal, Inc., Denver, Colo.

STATEMENT OF STEPHEN M. MUNSON, CHAIRMAN AND CHIEF EXECUTIVE OFFICER, MUNSON GEOTHERMAL, INC.

Mr. MUNSON. Thank you, Senator. Appreciate this opportunity to address some issues that we are concerned about.

I have been involved in the geothermal industry for 7 years. My company has been involved in Nevada in geothermal for 5 years. We have expended about $400,000 in our efforts to date.

Along with other members of the industry, we have observed many successes in exploration in Nevada.

Our major prospect is at Brady Hot Springs where our property surrounds the existing geothermal food processing site. We have property in Dixie Valley, and we are increasing our position in Nevada over the next month and a half.

You may not be fully aware that recently small wellhead powerplants have become available in the size range of a third of a megawatt to 10 megawatts. These skid-mounted powerplants are in some cases available as off-the-shelf units.

At least 10 vendors currently offer such plants. They can be hocked up and produce power several months after delivery.

The leadtime on these plants in the 5- to 10-megawatt range ranges from 1 year to 18 months instead of the 7- to 9-year leadtime of larger plants in Logan, Calif.

These small plants can also operate at considerably lower temperatures than the larger ones, thereby reducing drilling costs and risks since lower temperatures are often found at shallower depths.

I wish to stress that these small plants are really not all that small. Financing them is a major undertaking requiring either power contracts or reliable avoided costs at acceptable levels. Five-megawatt plant can cost from $5.3 million to $8 million depending on a number of factors. When considering total costs of a fossil fuel plant project, these geothermal plants are indeed competitive.

The potential scale of geothermal development in Nevada is much greater than is normally thought. Morrison-Knudsen, the large multinational engineering and construction company, is retained by Munson Geothermal, Inc., as a project consultant. They have estimated our single Brady Hot Springs site alone contains 58 to 178 megawatts. That is for 30 years minimum.

That is at least enough electricity for 58,000 to 178,000 Americans. Other sites we are completing acquisition of will presumably much increase our production potential. The impact of the industry as an industry is enormous.

It is probable that well over 3,000 megawatts of geothermal power are available for development in northern Nevada. In capital costs alone, this would generate an estimated $4,500 million in jobs and other development expenditures in Nevada.

At a wheeling charge of about 3.5 mils, this could generate upward of $52 million annually to Sierra Pacific Power Co., if 2,000 megawatts of those 3,000 megwatts were wheeled to sister States.

There are benefits to the utility industry that are not immediately obvious. The utility trade publication Electric Lights and Power in its April 1984 issue quoted Mr. William Gould, CEO of Southern California Edison, the Nation's fourth largest utility, speaking at their industry power meeting in Dallas:

> He made it clear that the benefits his company is receiving from its well-publicized alternative energy plan has little to do with kilowatt hours. Gould's assessment of solar, "We don't expect to get a great deal of energy, but we do get a great deal of publicity." Since announcing its program in 1980, SCE's stock price climbed from $24 a share to a high of $42 early in 1984, Gould related. Before the program, the utility was getting "beat around the ears" by regulators. "Now," said Gould, "we stand tall." (And as related earlier) and best of all SCE doesn't have to spend much of its own money.

So, there are benefits to this to the utilities. Sierra Pacific is to be applauded for its recent breakthrough on the three power contracts. But more are needed now.

It's been a blow to some of the companies, particularly smaller firms, expending funds in Nevada that only three contracts have been awarded to date. There are at least 15 to 20 potential production sites in this State. A number of them located near transmission lines which can be brought into power production soon.

Those companies which did not receive contracts have basically three options:

One, produce and sell power to Sierra Pacific at the avoided cost totaling only 5.9 cents per kilowatt-hour. Incidentally, Sierra Pacific, as you heard earlier, has filed to reduce even this low rate to 3.4 cents per kilowatt-hour.

The PSC has estimated to decide this matter in July of this year. We, of course, will strenuously object to their filing.

Item 2, this is another possibility. Arrange for the costly future transmission of power across new interconnect facilities to other utility purchasers to be constructed by our companies with or without utility involvement.

Third option, attempt to negotiate joint venture power development contracts with major customers of Sierra Pacific at rates—these are joint ventures—at rates comparable to those charged by the utility to its customers including industries and municipalities.

Herein lies the major—I suppose there is always a fourth option, too, and that is not to sell any power. The fourth option, of course, is not desirable.

The major bottleneck is really pretty obvious. Power contracts represent money to us because with them we can fully fund our projects.

For instance, by way of example, if our company had a signed contract now, we could be on line producing power in less than 6 months in Nevada. We have plant financing commitment totaling $7 million primarily contingent upon power contract receipts.

We may be able to arrange a relatively small demo project under avoided cost, but even this will be very difficult, perhaps impossible, under the threat posed by Sierra Pacific's recent filing proposal to move the low rates even lower.

It would be very helpful if the industry could develop more direct regulatory language from FERC. It would be helpful if the language dealing with avoided costs were slightly amended. We would have some proposed language if requested.

It would also be helpful if there were severe penalties, clear cut, attached to any entity, that could be assigned as penalties to any entity found to not be in complete compliance with the intent and language of the avoided-cost regulations.

There are other areas of contention. It would be very helpful if we could see some clarifications to the FERC regulations which would allow us to have these clarifications made through regulation rather than through expensive time-consuming massive litigation, which would be a most unfortunate problem for all concerned.

Utilities in many ways have even more to benefit from clarification of the FERC regs than does this industry. Although, for various reasons the utilities sometimes seem to lose track of this.

Another area to clarify is wheter or not a utility must purchase renewable utility energy if offered to it at its service territory boundary by a company developing resources outside its territory.

The other question is this question of turn-down letter. I am sure all of you are aware of some of the discussions, negotiations going on.

We, of course, do not believe that a turndown letter is required. Some parties dispute this.

It is possible that the present Nevada producer negotiations, discussions with Edison are moving beyond this question, but clarification would be helpful.

The FERC regs were clearly meant to help balance the scales between renewable energy development in the interests of national security and a livable environment. Hence, relatively modest clarifications of Federal regulatory language could do much to advance our ability to move forward.

The energy tax provisions of the IRS Code are of utmost importance to our ability to raise capital. Dr. Meidav's presentation I think was very astute. We ask that the elected officials of the State of Nevada support extension of the tax credits.

Sierra Pacific is not an extremely large utility, although it dwarfs all of our development companies together, if one considers only the independents and the goethermal subsidiaries of the oil and gas firms. It deserves some measure of empathy for it has a very difficult task.

Its mandate requires reliable service at the lowest possible cost. There is not much room in its budget for new technology development. It is very difficult to arrange for a sharing of new technology costs amongst ratepayers, even if there are enormous benefits relatively short timeframe.

It is possible that a high-level political discussion group amongst the elected and appointed officials could forge an innovative new arrangement of some sort allowing for the awarding of at least 10 more geothermal powerplant contracts to prove up additional reservoirs.

If a task force could be formed at the highest level to focus upon geothermal development, perhaps an innovative program could be developed relatively quickly. It has been suggested by Nevada citizens that such a task force might include as a starter the Governor or his representative, the Department of Minerals, the State engineer, the Public Service Commission, the Consumer Advocate, the two U.S. Senators, the local congressional delegation, three representatives of industry, and both large and small developers represented and a utility member.

We have another idea perhaps such a task force could consider. This may sound rather offbeat, but there was, however, discussion at one point in Washington concerning rolling in some of the geothermal technology development under the U.S. Synthetic Fuels Corp.

Compared to the funds now being allocated by it to oil shale and other less-proven technologies, this could result in relatively small investment given the size of potential results.

And I am virtually finished. It would be a drop in the bucket. The bang-for-the-buck payoff would be enormous. The savings on traditional fossil fuels are huge. If the suggestion is not unduly naive, I ask that you consider such an arrangement whereby the U.S. Synthetic Fuels Corp. would pay the differential between avoided costs on a rate of 7 cents or 9 cents per kilowatt-hour.

Thank you for the opportunity to make this presentation, and thanks for your continued support.

[The prepared statement of Mr. Munson follows:]

PRESENTATION BY STEPHEN M. MUNSON
BEFORE THE UNITED STATES SENATE
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
APRIL 17, 1984; SPARKS, NEVADA

IT IS A PLEASURE TO ADDRESS AN INTERESTED, HIGH LEVEL GROUP CONCERNING GEOTHERMAL ENERGY, THE MOST VIABLE, PROVEN SOURCE OF NON-POLLUTING RENEWABLE ENERGY LOCATED WITHIN THE BOUNDARIES OF THE UNITED STATES.

MY NAME IS STEPHEN MUNSON. I AM CHAIRMAN AND CHIEF EXECUTIVE OFFICER OF MUNSON GEOTHERMAL, INC., A PUBLICLY TRADED GEOTHERMAL DEVELOPMENT COMPANY WITH HEADQUARTERS IN DENVER, COLORADO AND PROPERTIES IN SEVERAL WESTERN STATES.

IN CHRONOLOGIC ORDER, IN THE PAST I HAVE SERVED AS AN INFANTRY CAPTAIN IN THE UNITED STATES ARMY, WAS EXECUTIVE DIRECTOR OF THE OREGON HOUSE OF REPRESENTATIVES TASK FORCE ON POLLUTION, RECEIVED AN MBA DEGREE WITH SPECIALIZATION IN FINANCE FROM THE STANFORD UNIVERSITY GRADUATE SCHOOL OF BUSINESS AND A MASTERS DEGREE IN POLITICAL SCIENCE FROM STANFORD, AND WAS EMPLOYED AS AN ASSOCIATE IN CORPORATE FINANCE FOR DILLON, READE & CO., AN OLD LINE NEW YORK INVESTMENT BANKING FIRM. WHILE THERE, I WAS PRIMARILY ASSIGNED TO LARGE ENERGY PROJECT FINANCIAL ANALYSES. I HAVE BEEN INVOLVED IN GEOTHERMAL DEVELOPMENT FOR THE PAST SEVEN YEARS.

MUNSON GEOTHERMAL HAS BEEN INVOLVED IN GEOTHERMAL ENERGY IN NEVADA FOR FIVE YEARS. WE HAVE EXPENDED ABOUT FOUR HUNDRED THOUSAND DOLLARS IN THIS EFFORT TO DATE. ALONG WITH

OTHER MEMBERS OF OUR INDUSTRY, WE HAVE OBSERVED MANY SUCCESSES IN RESOURCE EXPLORATION IN NEVADA. AS OTHERS WILL PROBABLY TESTIFY, TO DATE, AN ESTIMATED FIFTY MILLION DOLLARS HAS BEEN INVESTED BY THIS INDUSTRY IN THE STATE OF NEVADA ALONE.

OUR MAJOR NEVADA PROSPECT IS CURRENTLY BRADY HOT SPRINGS WHERE OUR 2,500 ACRE PROPERTY SURROUNDS THE 120 ACRE GEOTHERMAL FOOD PROCESSORS SITE. WE ALSO HAVE PROPERTY IN DIXIE VALLEY. OVER THE NEXT 45 DAYS, DESPITE THE PROBLEMS ENCOUNTERED TO DATE, WE EXPECT TO SUBSTANTIALLY INCREASE OUR COMMITMENT TO GEOTHERMAL DEVELOPMENT IN NEVADA BY MAKING ADDITIONAL MAJOR PROPERTY ACQUISITIONS HERE.

OUR CORPORATE OBJECTIVE IS NEAR TERM PRODUCTION OF ELECTRIC POWER FROM A NUMBER OF SITES IN NEVADA. OUR COMPANY COULD BE ON-LINE IN NEVADA IN LESS THAN 6 MONTHS IF CERTAIN FACTORS ARE CLARIFIED.

SOME OF YOU MAY NOT BE AWARE THAT GEOTHERMAL ENERGY IS FAR AND AWAY THE MOST ADVANCED AND SUCCESSFUL RENEWABLE ENERGY INDUSTRY IN THE WORLD. ENOUGH ELECTRICITY IS CURRENTLY BEING PRODUCED AND SOLD IN THE UNITED STATES TO MEET THE NEEDS OF MORE THAN ONE MILLION AMERICANS. MORE THAN 1,200 MEGAWATTS OF POWER ARE ON-LINE NOW, PRIMARILY IN NORTHERN CALIFORNIA.

TWO RECENT DEVELOPMENTS HAVE GIVEN A BOOST TO THIS INDUSTRY IN STATES OTHER THAN CALIFORNIA. MOST OF YOU ARE AWARE THAT IN MAY, 1983, THE UNITED STATES SUPREME COURT FOUND CERTAIN FEDERAL REGULATIONS WERE CONSTITUTIONAL IN AN 8 - 0 DECISION. THESE FEDERAL ENERGY REGULATORY COMMISSION

(FERC) REGULATIONS REQUIRE UTILITIES TO PURCHASE ALTERNATIVE ENERGY PRODUCED POWER AT THEIR "AVOIDED" INCREMENTAL COSTS. MAJOR BENEFITS RESULT TO UTILITY CUSTOMERS. A UTILITY TRADE PUBLICATION, ELECTRIC LIGHT AND POWER, IN ITS APRIL, 1984 ISSUE SAID, "AND, BEST OF ALL, SOUTHERN CALIFORNIA EDISION DOESN'T HAVE TO SPEND MUCH OF ITS OWN MONEY. THIRD PARTIES ARE INVESTING IN...(RENEWABLE ENERGY PROJECTS)...IN CALIFORNIA."

YOU MAY NOT BE AS AWARE OF ANOTHER MAJOR DEVELOPMENT. RECENTLY, SMALL WELLHEAD GEOTHERMAL POWER PLANTS HAVE BECOME AVAILABLE IN THE SIZE RANGE OF 330 KILOWATTS TO 10 MEGAWATTS. THESE SKID-MOUNTED POWER PLANTS ARE, IN SOME CASES, AVAILABLE AS "OFF-THE-SHELF" UNITS. AT LEAST 10 VENDORS CURRENTLY OFFER SUCH PLANTS. THEY CAN BE HOOKED UP AND PRODUCING POWER JUST SEVERAL MONTHS AFTER DELIVERY. THE LEAD TIME ON THE 5 TO 10 MW UNITS, PRODUCING ENOUGH POWER FOR UP TO 10,000 AMERICANS IS VERY SHORT. THEY CAN BE ORDERED AND INSTALLED IN 12 TO 18 MONTHS INSTEAD OF THE 7 - 9 YEAR LEAD TIME OF SOME OF THE LARGER GEOTHERMAL PLANTS NOW IN VOGUE IN CALIFORNIA. THESE SMALL PLANTS CAN ALSO OPERATE AT CONSIDERABLY LOWER TEMPERATURES THAN LARGE ONES, THEREBY REDUCING DRILLING COSTS AND RISKS SINCE LOWER TEMPERATURES ARE OFTEN FOUND AT SHALLOWER DEPTHS.

I WISH TO STRESS THAT THESE "SMALL" WELLHEAD PLANTS, HOOKED UP TO 1 TO 4 WELLS EACH ARE NOT ALL THAT SMALL IN REALITY. BECAUSE THEY ARE NOT REALLY SMALL, FINANCING THEM IS A MAJOR UNDERTAKING REQUIRING SIGNED POWER CONTRACTS OR

RELIABLE AVOIDED COSTS AT ACCEPTABLE LEVELS.

WELLHEAD PLANTS INVOLVE CAPITAL EXPENDITURES ON THE ORDER OF $75,000 TO $250,000 PER MEGAWATT FOR THE GEOTHERMAL RESOURCE, DEPENDING PRIMARILY UPON WELL DEPTHS, DRILLING COSTS AND RESOURCE CHARACTERISTICS. INSTALLED PLANT COSTS RUN FROM $1,000,000 TO $1,500,000 OR MORE PER MEGAWATT EXCLUSIVE OF TRANSMISSION COSTS AND DEPENDING UPON PLANT VENDOR, USED EQUIPMENT COMPONENTS, OPPORTUNITY COSTS OF WAITING DUE TO REGULATORY AND CONTRACT DELAYS AND TRANSMISSION LINE HOOKUP COSTS. THUS A 5 MEGAWATT PLANT CAN COST FROM 5.3 MILLION TO EIGHT MILLION DOLLARS. WHEN CONSIDERING TOTAL COSTS IF A FOSSIL FUEL PLANT PROJECT WERE STARTED TODAY, THESE GEOTHERMAL PLANTS ARE COMPETITIVE.

THE SUN DOES NOT SHINE ALL DAY NOR DOES THE WIND BLOW CONTINUALLY. WHEN A GEOTHERMAL WELL IS HOOKED UP IT PROVIDES CONTINUAL RELIABLE BASELOAD POWER SUBJECT ONLY TO PLANT MAINTENANCE AND WELL CLEANING. THE RESOURCE IS ON-LINE, ON-SITE. IT IS NOT, LIKE COAL ENERGY, SUBJECT TO THE VAGUENESS OF PREDATORY RAILROAD TRANSPORT CHARGES OR UNIONIZED MINEWORKER WAGE HIKES.

THIS INDUSTRY COULD EASILY MEET THE FUTURE NEEDS OF NEVADA CITIZENS AND EXPORT SUBSTANTIAL AMOUNTS OF POWER TO THE CITIZENS OF OTHER STATES NOT SO BLESSED. IN FACT, THE 1983 RESOURCE PLAN OF SIERRA PACIFIC POWER COMPANY FOUND GEOTHERMAL TO BE THE MOST FAVORED RESOURCE TO MEET FUTURE CAPACITY NEEDS. EXPORT OF POWER WILL PROVIDE JOBS AND INCOME IN THIS STATE AND COULD PROVIDE ENORMOUS WHEELING CHARGES TO LOCAL UTILITIES.

THE POTENTIAL SCALE OF GEOTHERMAL DEVELOPMENT IN NEVADA IS MUCH GREATER THAN IS NORMALLY THOUGHT. MORRISON-KNUDSEN, THE LARGE MULTI-NATIONAL ENGINEERING AND CONSTRUCTION COMPANY IS RETAINED BY MUNSON GEOTHERMAL, INC. AS A PROJECT CONSULTANT. THEY HAVE ESTIMATED OUR SINGLE BRADY HOT SPRINGS SITE ALONE TO CONTAIN AT LEAST 58 MW TO 178 MW OF POWER FOR THIRTY YEARS. HENCE, A PORTION OF JUST ONE 2,500 ACRE NEVADA RESOURCE IS ESTIMATED TO CONTAIN SUFFICIENT ELECTRIC POWER FOR 58,000 TO 178,000 AMERICANS FOR AT LEAST 30 YEARS. OTHER SITES WE ARE COMPLETING ACQUISITION OF WILL PRESUMABLY MUCH BOOST OUR PRODUCTION POTENTIAL. THE POTENTIAL IMPACT OF A FULLY DEVELOPED GEOTHERMAL INDUSTRY IN NEVADA IS STAGGERING.

TAKING A VERY QUICK LOOK AT THIS INDUSTRY IN NEVADA FROM MY CONVERSATIONS WITH OTHER DEVELOPERS AND PUBLISHED DEPARTMENT OF ENERGY AND U.S. GEOLOGIC SURVEY STUDIES, IT IS PROBABLE THAT WELL OVER 3,000 MEGAWATTS OF GEOTHERMAL POWER ARE AVAILABLE FOR DEVELOPMENT IN NORTHERN NEVADA. IN CAPITAL COSTS ALONE, THIS WOULD GENERATE AN ESTIMATED FOUR BILLION FIVE HUNDRED MILLION DOLLARS IN JOBS AND OTHER DEVELOPMENT EXPENDITURES IN NEVADA.

AT A WHEELING CHARGE OF $0.0035 PER KWH, THIS COULD GENERATE ABOUT $52,122,000 ANNUALLY TO SIERRA PACIFIC POWER COMPANY IF 2,000 MEGAWATTS OF THE 3,000 MEGAWATTS WERE WHEELED TO SISTER STATES. ASSUMING THAT A MINIMUM BALANCE OF 1,000 MEGAWATTS COULD BE USED IN NEVADA OVER THE NEXT 20 YEARS, THIS FIGURE ALONE REPRESENTS APPROXIMATELY 150% OF THE 650 MW OF POWER NOW USED BY SIERRA PACIFIC. IN OTHER WORDS, THE CURRENT SIERRA PACIFIC SYSTEM RELIANCE ON COAL AND OTHER TRADITIONAL POLLUTING ENERGY SOURCES (NOT ACCOUNTING FOR HYDRO PURCHASES) COULD BE FULLY REPLACED OVER TIME BY GEOTHERMAL, AND LATER EXPANDED BY AN ADDITIONAL POPULATION FACTOR OF TWO THIRDS AND STILL EXPORT AT LEAST ENOUGH NON POLLUTING RELIABLE ELECTRIC POWER FOR TWO MILLION AMERICANS.

FROM A NATIONAL PERSPECTIVE, SINCE GEOTHERMAL IS A VIRTUALLY NON POLLUTING RESOURCE IT WILL SUBSTANTIALLY REDUCE POLLUTION IN URBAN AREAS NOW REACHING UNACCEPTABLE LEVELS.

PHILOSOPHICALLY, THE GEOTHERMAL BUSINESS IS IN FACT THE COMMERCIAL END OF E.E. SCHUMACHERS SMALL IS BEAUTIFUL CONCEPT. WE CAN DEVELOP BENIGN ENERGY SOURCES ON AN INCREMENTAL REGIONAL BASIS. WE CAN MATCH ENERGY SUPPLY TO DEMAND AS POPULATION GROWS AND AS WE PHASE OUT RELIANCE ON FOSSIL FUELS. OUR INDUSTRY ALSO REPRESENTS THE PERSONIFICATION, WHEN DEVELOPED INTELLIGENTLY, OF THE SOFT ENERGY PATHS CONCEPT ESPOUSED BY LARGE UTILITY CRITIC AMORY LOVINS. THAT BOOK, BY THE WAY, IS SUBTITLED TOWARD A DURABLE PEACE. THAT SUBTITLE POINTS OUT ONE OF THE POSITIVE BENEFITS WHICH WOULD COME FROM A SUCCESSFUL MAJOR GEOTHERMAL INDUSTRY IN NEVADA. MANY MEN OF NATIONAL STATURE MORE KNOWLEDGEABLE THAN I HAVE STRESSED THE NEED TO QUICKLY DEVELOP OUR DOMESTIC RENEWABLE ENERGY RESOURCES FOR REASONS OF NATIONAL SECURITY. SECURE DOMESTIC ENERGY SOURCES REDUCE THE THREAT OF FORIEGN WARS.

WHAT OTHER BENEFITS MIGHT A UTILITY GAIN FROM A MAJOR COMMITMENT TO GEOTHERMAL IN NEVADA? I'LL LET THE C E O OF SOUTHERN CALIFORNIA EDISON, ONE OF THE NATION'S LARGEST

UTILITIES TELL YOU. THE UTILITY TRADE PUBLICATION ELECTRIC LIGHT AND POWER, IN ITS APRIL, 1984 ISSUE QUOTED MR. WILLIAM GOULD, C E O OF EDISON SPEAKING AT THE INDUSTRY WINTER POWER MEETING IN DALLAS;

"HE MADE IT CLEAR THAT THE BENEFITS HIS COMPANY IS RECEIVING FROM ITS WELL PUBLICIZED ALTERNATIVE ENERGY PLAN HAS LITTLE TO DO WITH KILOWATT HOURS. GOULD'S ASSESSMENT OF SOLAR, 'WE DON'T EXPECT TO GET A GREAT DEAL OF ENERGY, BUT WE DO GET A GREAT DEAL OF PUBLICITY.' SINCE ANNOUNCING ITS PROGRAM IN 1980 SCE'S STOCK PRICE CLIMBED FROM $24 A SHARE TO A HIGH OF $42 EARLY IN 1984, GOULD RELATED. BEFORE THE PROGRAM, THE UTILITY WAS GETTING 'BEAT AROUND THE EARS' BY REGULATORS. 'NOW,' SAID GOULD, ' WE STAND TALL'. (AND AS RELATED EARLIER) AND BEST OF ALL SCE DOESN'T HAVE TO SPEND MUCH OF ITS OWN MONEY."

UNLIKE THE NEAR TERM PROSPECTS FOR SOLAR AS A GEOTHERMAL COMPANY PRESIDENT, I CAN PROMISE YOU THAT OUR INDUSTRY WILL DELIVER POWER AS WELL AS RHETORIC. GIVEN CONTRACTS IN PLACE OR AVOIDED COSTS AT PREDICTABLE ACCEPTABLE LEVELS, NEVADA PRODUCERS WILL DELIVER POWER IN LARGE AMOUNTS.

DEVELOPMENT OF A MINIMUM OF 3,000 MW OF POWER IN NEVADA WOULD SAVE THE VARIOUS UTILITIES RECEIVING THE POWER AN ESTIMATED FOUR BILLION FIVE HUNDRED MILLION DOLLARS IN CAPITAL COSTS AT CURRENT DOLLARS.

UNLIKE A NUMBER OF OTHER EXOTIC ENERGY ALTERNATIVES, GEOTHERMAL INDUSTRY TECHNOLOGY IS WELL DEVELOPED AND WE, AS AN INDUSTRY, HAVE CLEARLY DEMONSTRATED OUR COMMITMENT TO AND

BELIEF IN ITS POTENTIAL BY EXPENDING SOME FIFTY MILLION DOLLARS TOWARDS ITS DEVELOPMENT IN THE STATE OF NEVADA ALONE.

TO FURTHER THE NEAR TERM DEVELOPMENT OF GEOTHERMAL IN THIS STATE, IT IS MY OPINION THAT THE THREE CONTRACTS AWARDED BY SIERRA PACIFIC RECENTLY REPRESENT A MERE DROP IN THE BUCKET COMPARED TO WHAT SHOULD HAVE BEEN UNDERWAY ALREADY IN THIS STATE. SIERRA PACIFIC IS TO BE APPLAUDED FOR ITS RECENT BREAKTHROUGH ON THESE CONTRACTS BUT MORE ARE NEEDED NOW. IT HAS BEEN A BLOW TO SOME OF THE COMPANIES PARTICULARLY THE SMALLER FIRMS EXPENDING FUNDS HERE THAT ONLY THREE CONTRACTS HAVE BEEN AWARDED TO DATE.

THIS MAY SOUND LIKE SOUR GRAPES. IT REALLY IS NOT. THE POINT IS NOT BITTERNESS ENGENDERED OVER CERTAIN CONTRACTS BUT RATHER THAT THERE WERE ONLY THREE CONTRACTS AWARDED WHEN THERE ARE AT LEAST 15 TO 20 POTENTIAL PRODUCTION SITES IN THIS STATE, A NUMBER OF THEM LOCATED NEAR TRANSMISSION LINES WHICH COULD BE BROUGHT INTO POWER PRODUCTION SOON.

THOSE COMPANIES WHICH DID NOT RECEIVE CONTRACTS, OR WHICH RECEIVED A CONTRACT FOR ONLY ONE OF SEVERAL DEVELOPMENT SITES, MUST NOW CONSIDER THREE POSSIBILITIES:

ONE: PRODUCE AND SELL POWER TO SIERRA PACIFIC AT AN AVOIDED COST TOTALLING ONLY $0.059 PER KWH. INCIDENTALLY, SIERRA PACIFIC HAS FILED TO REDUCE EVEN THIS LOW RATE TO $0.034 PER KWH. THE PSC IS ESTIMATED TO DECIDE THIS MATTER IN JULY OF THIS YEAR. WE, OF COURSE, WILL STRENUOUSLY OBJECT TO THEIR FILING.

TWO: ARRANGE FOR THE COSTLY FUTURE TRANSMISSION OF

POWER ACROSS NEW INTERCONNECT FACILITIES TO OTHER UTILITY PURCHASERS TO BE CONSTRUCTED BY OUR COMPANIES WITH OR WITHOUT UTILITY INVOLVEMENT WHICH APPROACH IS UNDER SERIOUS EVALUATION NOW DRIVEN BY A SERIOUS NEED FOR RELIABLE MARKETS.

THREE: ATTEMPT TO NEGOTIATE JOINT VENTURE POWER DEVELOPMENT CONTRACTS WITH MAJOR CUSTOMERS OF SIERRA PACIFIC AT RATES COMPARABLE TO THOSE CHARGED BY THE UTILITY TO ITS CUSTOMERS INCLUDING INDUSTRIES AND MUNICIPALITIES.

HEREIN LIES THE ONLY MAJOR BOTTLENECK. AS WE ALL KNOW, MONEY IS THE MOTHER'S MILK OF POLITICS. SO IS MONEY THE NUTURING AGENT OF TECHNOLOGICAL CHANGE, IN THE UTILITY INDUSTRY AS OTHERS. POWER CONTRACTS REPRESENT MONEY TO US BECAUSE WITH THEM WE CAN FULLY FUND OUR PROJECTS. EVEN IN THE CASE OF THE GEOTHERMAL SUBSIDIARIES OF THE MAJOR OIL AND GAS COMPANIES, THEY MUST JUSTIFY TO TOP MANAGEMENT INCREASED EXPENDITURES FOR MORE WELLS AND FOR POWER PLANT DESIGN AND CONSTRUCTION. THEY DO NOT HAVE UNLIMITED FUNDS. SIGNED POWER CONTRACTS ARE ESSENTIAL TO ASSIST ALL OF US IN MOVING ON A FAST TRACK IN NEVADA.

IF WE HAD A SIGNED CONTRACT FOR EXAMPLE, MY COMPANY COULD BE ON LINE PRODUCING POWER IN LESS THAN 6 MONTHS. WE HAVE PLANT FINANCING COMMITMENTS TOTALLING SEVEN MILLION DOLLARS PRIMARILY CONTINGENT UPON POWER CONTRACT RECEIPT.

AS A SINGLE MINDED GEOTHERMAL COMPANY, THE MATTER OF POWER CONTRACTS ARE EVEN MORE IMPORTANT THAN WITH THE LARGER FIRMS. WE MAY BE ABLE TO ARRANGE A RELATIVELY SMALL DEMONSTRATION PROJECT UNDER AVOIDED COSTS, BUT EVEN THIS WILL BE VERY DIFFICULT, PERHAPS IMPOSSIBLE UNDER THE THREAT POSED

BY SIERRA PACIFIC'S RECENT FILING PROPOSING TO MOVE PRESENT LOW AVOIDED COST RATES DOWN. TO UNDERTAKE SIGNIFICANT DEVELOPMENT IN NEVADA, WE, AS AN INDUSTRY, MUST EITHER HAVE SIGNED POWER CONTRACTS FROM SIERRA PACIFIC OR AVOIDED COSTS AT PREDICTABLE ACCEPTABLE LEVELS. THE FOLLOWING REGULATORY CLARIFICATION WOULD HELP IMMEASURABLY.

MORE DIRECT AND FORCEFUL LANGUAGE FROM FERC WOULD BE MOST HELPFUL. IT WOULD BE HELPFUL TO OUR INDUSTRY IF THE FERC REGULATORY LANGUAGE REQUIRING PURCHASE AT AVOIDED COST WERE SLIGHTLY AMENDED. WE WOULD BE PLEASED TO SUBMIT SOME MODEST CLARIFYING PROPOSALS FOR CONSIDERATION IF REQUESTED. OTHER COMPANIES WOULD PROBABLY HAVE SUGGESTIONS AS WELL.

IT WOULD BE HELPFUL IF THERE WERE CLEAR, EASILY ASSIGNABLE SEVERE PENALTIES ATTACHED TO ANY ENTITY FOUND NOT TO BE IN COMPLETE COMPLIANCE WITH THE INTENT AND LANGUAGE OF AVOIDED COST REGULATIONS. PERHAPS A MECHANISM COULD BE ESTABLISHED BY FERC UNDER WHICH A MONOPOLISTIC MANDATE OF THE ORGANIZATION COULD BE CHALLENGED OVER PROVEN NON COMPLIANCE.

THERE ARE SEVERAL OTHER AREAS OF CONTENTION CONCERNING FERC LANGUAGE WHICH COULD ALSO FAR ADVANCE DEVELOPMENT OF THIS UNDER-UTILIZED NATIONAL TREASURE. IT IS ESSENTIAL TO SEE THESE CLARIFICATIONS SETTLED THROUGH REGULATION RATHER THAN THROUGH EXTENSIVE, EXPENSIVE, TIME CONSUMING MASSIVE LITIGATION. THE UTILITIES IN MANY WAYS HAVE EVEN MORE TO BENEFIT FROM CLARIFICATION OF THE FERC REGULATIONS THAN DOES THIS INDUSTRY, ALTHOUGH FOR VARIOUS REASONS, THE UTILITIES SEEM TO LOSE SIGHT OF THIS FACT.

ONE AREA TO CLARIFY IS WHETHER OR NOT A UTILITY IN FACT MUST PURCHASE RENEWABLE ENERGY ELECTRICITY IF OFFERED TO IT AT ITS SERVICE TERRITORY BOUNDARY BY A COMPANY DEVELOPING RESOURCES OUTSIDE ITS TERRITORY.

RELATEDLY, MUST A UTILITY FORCE A DEVELOPMENT COMPANY TO FIRST OFFER ITS POWER TO THE LOCAL UTILITY WHERE IT HAPPENS TO PRODUCE THE POWER AND, IF IT MUST BE OFFERED, MUST THE LOCAL UTILITY COUCH ITS "TURN DOWN LETTER" WITH TERMS SUCH AS, "WILL NOT PURCHASE AT THE RATE THE DEVELOPER WANTS BUT WILL PURHCASE AT OUR AVOIDED COST OF _______." THE CATCH 22 PROBLEM WE ARE SUFFERING FROM IS, HOW TO ARRANGE A SIGNED CONTRACT WITH AN EXTERNAL UTILITY AT ACCEPTABLE LEVELS. WE DO NOT BELIEVE THAT SUCH A "TURN DOWN LETTER" IS REQUIRED. SOME PARTIES DISPUTE THIS. FEDERAL CLARIFICATION WOULD BE HELPFUL. IMPLICIT IN THE FOREGOING IS THE POSITION OF SOME EXECUTIVES WITHIN CERTAIN UTILITIES THAT WE, AS DEVELOPERS, MUST TAKE THE LOCAL RATE, OR CHOSE NOT TO PRODUCE, NO MATTER HOW DISASTEROUSLY LOW A UTILITY MAY ATTEMPT TO SET ITS LEVEL AS IN THE PRESENT SIERRA PACIFIC FILING ON AVOIDED COSTS.

THE FERC REGULATIONS WERE CLEARLY MEANT TO HELP BALANCE THE SCALES TO ENABLE RENEWABLE ENERGY DEVELOPMENT IN THE INTEREST OF NATIONAL SECURITY AND A LIVABLE ENVIRONMENT. HENCE, RELATIVELY MODEST CLARIFICATIONS OF FEDERAL REGULATORY LANGUAGE COULD DO MUCH TO ADVANCE OUR ABILITY TO MOVE FORWARD. TIMELY CONTRACTS ASSURE OUR ABILITY TO RAISE THE REQUISITE FINANCING TO ADVANCE OUR PROJECTS IN NEVADA.

AFTER POWER CONTRACTS WERE SIGNED IN NORTHERN CALIFORNIA, THE PACE OF DEVELOPMENT GREATLY EXCELERATED ABOUT

10 YEARS AGO. WE, AS AN INDUSTRY IN NORTHERN NEVADA, CAN EVEN EXCEED THE ASTOUNDING GEOTHERMAL DEVELOPMENTS IN NORTHERN CALIFORNIA IF GIVEN HALF A CHANCE.

THERE IS ONE AREA OF FEDERAL REGULATION WHICH WE ASK BE EXTENDED IN ITS PRESENT FORM WITHOUT NEED OF CLARIFICATION. THE ENERGY TAX PROVISIONS OF THE IRS CODE ARE OF UTMOST IMPORTANCE TO OUR ABILITY TO RAISE CAPITAL. WITHOUT THESE TAX CREDITS EXTENDED FOR A PERIOD OF 3 TO 5 YEARS, THE FUTURE OF A FAST PACED GROWTH OF THE GEOTHERMAL INDUSTRY WILL BE SERIOUSLY JEOPARDIZED. WE ASK THAT THE ELECTED OFFICIALS OF THE STATE OF NEVADA VIGOROUSLY SUPPORT EXTENSION TO THE ENERGY TAX CREDITS.

SIERRA PACIFIC IS NOT AN EXTREMELY LARGE UTILITY ALTHOUGH IT DWARVES ALL OF OUR DEVELOPMENT COMPANIES TOGETHER, IF ONE CONSIDERS ONLY THE INDEPENDENTS AND THE GEOTHERMAL SUBSIDIARIES OF THE OIL AND GAS FIRMS. IT DESERVES SOME MEASURE OF EMPATHY FOR IT HAS A VERY DIFFICULT TASK. ITS MANDATE REQUIRES RELIABLE SERVICE AT THE LOWEST POSSIBLE COST. THERE IS NOT MUCH ROOM IN ITS BUDGET FOR NEW TECHNOLOGY DEVELOPMENT. IT IS VERY DIFFICULT TO ARRANGE FOR A SHARING OF NEW TECHNOLOGY COSTS AMONGST RATE PAYERS EVEN IF THERE ARE ENORMOUS BENEFITS RELATIVELY NEAR TERM.

WE NEED THE REGULATORY CLARIFICATIONS LISTED EARLIER PRIMARILY TO MAKE OUR TASK LESS BURDENSOME IN DEALING WITH NON-NEVADA UTILITIES.

INTERNAL TO THE STATE, IT IS POSSIBLE THAT HIGH LEVEL POLITICAL DISCUSSIONS AMONGST THE ELECTED AND APPOINTED

OFFICIALS COULD FORGE AN INNOVATIVE NEW ARRANGEMENT OF SOME SORT ALLOWING FOR THE AWARDING OF AT LEAST 10 MORE GEOTHERMAL POWER PLANT CONTRACTS TO PROVE UP ADDITIONAL RESERVOIRS EACH IN THE RANGE OF 5 MEGAWATTS TO 10 MEGAWATTS. OUR FIRM IS RELATIVELY NEW TO YOUR STATE. WE CANNOT HOPE TO RECOMMEND A SPECIFIC COURSE OF ACTION TO YOUR CITIZENS AND ELECTED OFFICIALS. HOWEVER, IF A TASK FORCE COULD BE FORMED AT THE HIGHEST LEVEL TO FOCUS UPON GEOTHERMAL DEVELOPMENT, PERHAPS AN INNOVATIVE PROGRAM COULD BE DEVELOPED RELATIVELY QUICKLY. IT HAS BEEN SUGGESTED BY NEVADA CITIZENS THAT SUCH A TASK FORCE MIGHT INCLUDE AS A STARTER THE GOVERNOR OR HIS REPRESENTATIVE, THE DEPARTMENT OF MINERALS, THE STATE ENGINEER, THE PUBLIC SERVICE COMMISSION, THE CONSUMER ADVOCATE, THE 2 U.S. SENATORS, THE LOCAL CONGRESSIONAL DELEGATION AND 3 REPRESENTATIVES OF INDUSTRY INCLUDING REPRESENTATIVES OF BOTH LARGE AND SMALL DEVELOPERS.

AS ONE PERHAPS OFF-BEAT IDEA, THERE WAS AT ONE POINT DISCUSSION IN WASHINGTON CONCERNING INCLUSION OF SOME PORTION OF GEOTHERMAL TECHNOLOGY DEVELOPMENT UNDER THE U.S. SYNTHETIC FUELS CORPORATION WHICH IS NOW ACTIVE AT LAST. IS THERE ANY CHANCE THAT A 10 YEAR PRICE SUPPORT MECHANISM COULD BE WORKED OUT WHEREBY THE SYNTHETIC FUEL CORPORATION WOULD PAY THE DIFFERENCE BETWEEN AVOIDED COSTS AND A RATE OF $0.07 AND $0.09 PER KWH TO PROVE UP 10 TO 15 MORE GEOTHERMAL RESERVOIRS IN NEVADA?

COMPARED TO THE FUNDS NOW BEING ALLOCATED BY IT TO OIL SHALE AND OTHER LESS PROVEN TECHNOLOGIES, THIS SUGGESTION EVEN COMPRISING ALL WESTERN STATES WOULD BE BUT A PROVERBIAL

DROP IN THE BUCKET. THE "BANG FOR THE BUCK" PAYOFF WOULD BE ENORMOUS; THE SAVINGS ON TRADITIONAL FOSSIL FUELS HUGE. IF THIS SUGGESTION IS NOT UNDULY NAIVE, I ASK THAT YOU CONSIDER IT.

IN SUMMARY, GEOTHERMAL TECHNOLOGY IS WELL DEVELOPED. RESOURCES ARE CONSIDERED PROVEN THROUGHOUT NORTHERN NEVADA. OUR INDUSTRY, PARTICULARLY WITH THE RECENT ADVENT OF SMALL WELLHEAD POWER PLANTS IS READY TO MARCH SMARTLY FORWARD. THANK YOU FOR THIS OPPORTUNITY TO PRESENT OUR POSITION ON THIS IMPORTANT MATTER.

Senator **HECHT**. Thank you very much.

How effective has the Public Utilities Regulatory Policies Act of 1978 [PURPA] been in assuring a market for geothermal power in Nevada? I will ask all of you, if anyone would like to comment on it.

Mr. **KRUMLAND**. I don't believe that the PURPA 1978 Act has been very effective in Nevada because of the lack of clarity in the regulation and in the methodology of calculating avoided cost.

The utilities tend to calculate avoided cost based upon the short range of rated cost, which does not necessarily take into account the actual cost of construction of the powerplant. In their defense, they argue that indeed, they do not need to build any additional powerplants at this time because of the market glut.

On the other hand, developers feel that the proper way to handle the situation is to take into account the long-range avoided cost, which would indeed take into account the cost of actual construction of the powerplant.

Therefore, in my opinion, there is a need for greater clarity in establishing the methodology of how avoided cost is to be calculated.

Senator **HECHT**. Mr. Munson, Mr. Meidav, you are asking for more Federal leadership in requiring the payment of true avoided cost. While this would be helpful I cannot overemphasize the importance of your working with the State PSC on this problem.

How do you feel about that?

Mr. **MUNSON**. We have retained counsel, expert counsel to assist us in this matter, and of course, will be appearing on the question of lowering avoided costs. You are absolutely right, Senator, of course.

Senator **HECHT**. I have asked the last panel whether they had intervened in the PSC's avoided-cost rulemaking. Have any of you been active on this?

Mr. **KRUMLAND**. We have not been active so far. Although, let's add that the involvement of the geothermal developers of northern

Nevada in an active fashion in the whole legislative arena is a very young one.

We are proceeding at this moment in dialogue with utilities, primarily across the border. It would be most desirable if we could develop a dialogue with the local utilities, especially with the Sierra Pacific Power Co., in a way that would perhaps allow us to avoid the regulatory process all together.

Senator HECHT. Yes, Mr. Munson.

Mr. MUNSON. We are expending funds to lay our case before the governing authorities.

Senator HECHT. Are any of your companies working on ways to finance and construct a transmission line to southern California?

Mr. MUNSON. This question is being evaluated independently by a number of the companies that are doing business in northern Nevada. No formalized group has yet jelled.

There are questions of antitrust that are being explored by expert counsel. My expectation is that such a group will be formed formally, perhaps more than one group over the next 1 to 3 months.

Senator HECHT. Did you want to say something, Dr. Meidav?

Dr. MEIDAV. I wanted to add to it specifically that at this moment there are two specific plans that have been presented by the developers. One of them is the one that Mr. Munson referred to, and that is an effort by a group of companies working together with Sierra Pacific and Edison in studying a collector transmission system that would lead the electricity developed in a number of geothermal fields into the Edison system in southern California.

Another proposal, which is being pursued by some geothermal, would involve initially only Dixie Valley developers, and that is to run a direct line from Dixie Valley straight into Bishop.

Senator HECHT. A major concern on the part of many geothermal lessees is the State/Federal acreage limitation of 20,480 acres. Is this a problem for you gentlemen?

Mr. MUNSON. I find it to be at the present time, as of today, I do not find it restrictive. However, given the plans of our company, I feel that that is unduly restrictive.

Senator HECHT. How do you feel?

Mr. MUNSON. We support your pending legislation.

Dr. MEIDAV. We feel the same way, that the acreage limitation should be modified to 51,000 acres.

Senator HECHT. Mr. Krumland, any comments on that?

Mr. KRUMLAND. We are not directly involved in the resource development. I think anything that helps the resource developers go forward that we are definitely in favor of because we are interested in getting the powerplant started.

Senator HECHT. Another pressing problem identified by geothermal developers is a problem associated with having a producing or producable well, with no contract for the sale of the energy from such wells. Many companies are facing the prospect of having to relinquish their leases because of this.

Is this a problem for any of you?

Mr. MUNSON. That is not a problem for us. Although, we are in the process of attempting to develop our properties in the short term.

That is a problem for a number of other people. It's been calculated that well over $50 million is in the ground in Nevada now in geothermal development. I believe Dr. Meidav calculated it. What was it, $25,000 a day in interest costs foregone alone?

People are facing losing their leases. More than that, they are faced with the prospect of losing their investment if you don't get moving.

Dr. MEIDAV. We would like to add to it that at this moment there is more than 50 megawatts of shut-in energy in the ground that could have been connected to powerplants and be producing electricity at this time.

Like any other investment that has already been made to the tune of several tens of millions of dollars, not bearing any revenue, it continuously erodes the quality and value of the investment.

And therefore, any plan that could be developed that would expedite the total process from successful exploration to power on line would be a great boon to geothermal developers in Nevada.

Senator HECHT. Thank you very much. Anything else?

We will now have panel No. 5. Our first witness is Max Jones representing Mr. Gremban, the president of the Sierra Pacific Power Co., Reno, Nev., and I think in all deference to you, after hearing so much about your company, you ought to have the chance to come back at the end to make another statement.

STATEMENT OF JOE L. GREMBAN, PRESIDENT AND CHIEF EXECUTIVE OFFICER, SIERRA PACIFIC POWER CO., AS PRESENTED BY MAX JONES, SENIOR VICE PRESIDENT

Mr. JONES. Thank you, Senator.

First off I apologize for Mr. Gremban not being able to stick around. He did have another speech that he had to deliver, and I guess maybe he took off with all the staff.

On behalf of Sierra Pacific Power Co., I would like to thank you, Senator Hecht, and your committee, for the opportunity to testify on geothermal development in the Great Basin.

As mentioned, I am Max Jones, senior vice president and have the planning engineering construction portion of the utility's responsibilities. We are located in Reno.

Sierra Pacific serves about 190,000 electric customers in northern Nevada and California, and we have a peak demand this year of some 688 megawatts, and to put things in perspective a little bit, because we are being encouraged to buy a lot of this geothermal power, PG&E, as an example, has 18,000-megawatt demand compared to our almost 700. That makes them about 250 times larger than we are.

Another example, if we were to buy the 10 megawatts from each of the developers, say 15 of them, that would be 150 megawatts. That's over a third of our average load. That would probably boost our rates somewhere in the neighborhood of 35 to 40 percent.

I am sure that you read the papers enough to know that we catch enough hell as it is with the rates we have, and so, that is why we have to be very cautious about the avoided cost or the costs that we are willing to pay developers.

We also serve about a 50,000-square-mile area of Nevada, and includes most of the areas where our geothermal resources are located.

By way of history, Sierra Pacific has been very interested in the development of geothermal generation. Some twenty years ago one of the first assignments I received as a young engineer coming on board was to take over the supervision and put to bid a drilling activity for geothermal resource at Beowawe, Nev.

In that case we had a 5-megawatt generator on order.

More recently, we worked with other utility participants trying to put a group together to minimize risk. That group was known as NORNEV, and we are moving to relocate and develop a small demonstration pilot project.

More recently, as you have heard today, we have dealt with literally all of the geothermal developers in negotiations and have come down to three on a competitive basis that we feel would demonstrate a pilot project adequately for the company.

The inability of the NORNEV participants to complete a project is probably very indicative of the problems that Sierra Pacific and other utilities face. No. 1, we have a declining need for new capacity over the near term. This is something found by nearly all utilities.

Second, we have financial constraints that face us that limit where we can invest our money.

Third, we received negative treatment with respect to research and development expenditures by the regulatory agencies in not only our State, but this has been widely experienced in other States.

One of the main questions that have come up here is the avoided cost. The availability of low-cost hydro, coal, and nuclear power in the West has served to substantially reduce the utility margin or avoided costs.

As an example, yesterday I happened to talk to some of our control people. We were buying energy out of the northwest from one source at less than a mil or less than a penny, at 90 mils, and from other sources, three other sources, in the 1- to 1½-cent range.

I might point out that any production that we would have from geothermal on a base basis would result in deferring an equal amount of emergy purchases from the Northwest.

The availability of economy energy over the past 2 years has resulted in we have purchased about 66 percent of our energy out of the Northwest transmission line, and we have saved our customers somewhere around $70 million over this period of time.

I won't go into the deteriorating financial condition of many of the companies. But that again is another deterrent to spending capital in what you might refer to as risk developments.

We have also been criticized for expenditures in the R&D areas. As an example, we did our drilling on the geothermal development at Beowawe. The dollars there were not allowed to be passed on to ratepayers, and again, were absorbed by the stockholders.

Obviously, you don't do this very long and keep your job. In spite of some of these negative factors, we do feel that the geothermal generation has many potential advantages.

The plants may be economically criticized in increments that match our load growth. About the smallest coal plant that would be economical today is around 250 megawatts. Obviously, that would result in excess capacity for a year or two.

The construction time for small plants, geothermal type, are in the 2- to 3-year timeframe, as opposed to maybe 10 years for a coal plant. The obvious savings in cost due to interest incurred is obvious.

Geothermal plants show a potential for long-term high-capacity factor operation. We have seen some very excellent operations in California. The Roosevelt development also looked very good.

One of the big points in looking at geothermal resources in Nevada is that they are not subject to fuel transportation problems. With coal in our system we now face the possibility of railroad strikes or the increasing cost of rail tariffs to deliver that coal, which add to the uncertainty of the coal prices.

Additionally, importing oil by rail also faces the same problems, importing gas for some of our generation by pipeline in the wintertime when it is needed most, many times faces restrictions.

In comparison to other technology, the cost of geothermal resources is expected to decline as the technology advances. Further diversification of energy resources can result in a stable energy supply and minimize the impacts on energy costs.

And in the West, while we do not have the same SO_2 emission problems that our Eastern counterparts do, the future acid drain legislation could add dramatically to the uncertainty of the coal plant costs. All of these items favor the geothermal development.

Some of our plans have been mentioned here today. Basically, what we have decided to do and the path we have taken is to encourage and try to come up with three developments that show the potential resource or prove the potential resource on three sites with three different technologies. We feel this would be adequate to prove the geothermal resource as it might be adapted in our long-range resource plans.

Down the road as a part of these initial contracts we have negotiated parts where we can also buy into the development in the future and thus hold some of our rates down.

We do require regulatory support in these matters. Obviously, our contracts have to be approved by the Public Service Commission, and we have to be essentially guaranteed that we can pass those costs on, that we do not have to absorb any increased costs for the geothermal energy.

Future development, our main effort in this effort has been to look at what transmission opportunities are available. We are very active and recently budgeted $1½ million to do the permitting for a transmission line that would go south of Tahoe and tie in with the SMUD facility.

We are also involved with Idaho Power and with PG&E to determine a pass for a major transmission interconnection to the North.

And probably closer to reality, we are working with Southern Cal Edison, and as mentioned, some of the geothermal developers, to determine the feasibility of an interconnection between our systems.

I might just comment that the future or the possibility of getting a future interconnection looks very bright at this particular time, providing we do get some support from the Federal agencies that do the permitting.

As far as congressional support goes, we do support the position that's been mentioned earlier on lease explorations, the tax credit extensions.

We feel that you can help us by maybe encouraging some of the agencies to act a little more quickly on some of our transmission right-of-way applications. In particular, the U.S. Forest Service, the wilderness problems we have run into. I might comment that the BLM over the years has been very cooperative, and I think we have developed a very good relationship there.

In conclusion, we do support the geothermal development. We'd like to encourage it. We'd like to be doing more.

We are just as frustrated as many of the developments, and we thank you for taking the opportunity to come out to Nevada to help find out what is going on and hopeful look forward to your support and get something done in the future.

[The prepared statement of Mr. Gremban follows:]

Sierra Pacific Power Company SPP

STATEMENT OF

JOE L. GREMBAN
PRESIDENT & CHIEF EXECUTIVE OFFICER
SIERRA PACIFIC POWER COMPANY

REGARDING
GEOTHERMAL DEVELOPMENT

BEFORE THE
SENATE SUBCOMMITTEE ON ENERGY
AND MINERAL RESOURCES

SPARKS, NEVADA
April 17, 1984

Sierra Pacific Power Company

On behalf of Sierra Pacific Power Company, I thank the Subcommittee for the opportunity to testify on geothermal development in Nevada's Great Basin.

I am Joe Gremban, President and Chief Executive Officer of Sierra Pacific Power Company with headquarters in Reno, Nevada.

Sierra Pacific Power Company serves 190,000 electric customers in Northern Nevada and California, with a peak demand in January 1984 of 688 MW. Our service territory encompasses over 50,000 square miles, and includes a large percentage of the known Geothermal Resource Areas of the Great Basin. In Northern Nevada, nearly a dozen potential resource sites have been identified with producible reservoirs in the 300-500° F range. A substantially larger resource also exists at less than 300° F that lends itself to small scale power production or direct use.

HISTORY

Sierra has been vitally interested in the development of geothermal generation for more than 20 years. We have participated in drilling activities, resource evaluation, and generation technology assessment since the early 1960's. More recently, Sierra worked with four other utility participants in an organization known as NORNEV to locate and develop a small demonstration pilot project. Currently, Sierra has an application before the Public Service Commission of Nevada that will allow purchase of 24 MW of geothermal generation.

UTILITY FACTORS

The inability of the NORNEV participants to complete a project is symptomatic of the problems facing the emerging geothermal industry. The following three factors contributed to the shelving of the Northern Nevada Joint Utility Geothermal Project.

1. Declining need for new capacity over the near term by all the participating utilities.

2. Financial constraints facing the participants.

3. Negative treatment of research and development expenditures by regulatory agencies in various states.

The reduced need for new capacity presents a multi-pronged problem for geothermal development. Western utilities are not making committments for new generating capacity at this time as resource plans indicate that additional generation is not required until the early to mid 90's. With the completion of our second Valmy coal fired unit in Northern Nevada, Sierra's own generation needs will be met into the early 90's with current resources.

The availability of lower cost hydro, coal, and nuclear generation in the West has served to substantially reduce utility marginal or "avoided" costs. The cost a utility avoids when purchasing customer generation declines as the percentage of economy purchases increases. The purchases of higher cost geothermally generated energy is difficult to justify to customers when a large surplus of less expensive energy is available. The availability of economy energy throughout the West is serving to provide short term stability to rates, but discourages PURPA type development due to the resulting reduction in utility "avoided" costs. We purchased 66% of our energy requirements in 1983, saving our customers $36 million dollars over the cost of generating the electricity from our oil/gas plants.

Sierra's deteriorated financial condition has limited its ability to participate in long term projects like NORNEV. Projects of this nature actively compete for capital dollars required to meet the immediate needs of our customers. Other project participants experienced similar constraints.

Additionally, utilities have been criticized for research and development expenditures for projects that are not required to meet immediate customer needs. Sierra was unable to recover early geothermal exploration expenditures, thereby discouraging further participation. There is significant likelihood that the costs borne by utilities in the development of geothermal generation will not be recoverable through the regulatory process.

These factors have led Sierra to seek alternative means to encourage geothermal development in order to gain the knowledge required.

ADVANTAGES

In spite of these constraints, we recognize that geothermal generation has several potential advantages. If liquid dominated geothermal resources are to compete with other alternatives, the development of pilot projects must begin as soon as possible. Nevada resources have not been developed to the stage that these costs can be proven to be competitive with resource options. Potential advantages include:

1. Plants may be economically sized in smaller increments to more closely match load growth requirements. The smallest economical coal plant would be about 250 MW. Geothermal units may be economic in the 20-50 MW range.

2. Construction time for small plants is two to three years in comparison to seven to ten years for coal plants. It is far easier to predict future needs three years in the future, than it is to predict needs 10 years down the road. Thus, it should be easier to match actual needs and avoid costly under or overcapacity situations.

3. Geothermal plants show a potential for long term high capacity factor operation.

4. In Nevada, geothermal resources are not subject to fuel transportation problems and storage is not required. The possibility of rail strikes is a major concern when considering new coal plants. The cost of delivered coal is highly impacted by rail tariffs which add a great deal of uncertainty to coal prices -- a situation which would not exist with geothermal units.

5. In comparison to other technologies, the capital cost of geothermal facilities is expected to decline as technology advances.

6. Further diversification of energy sources can assure a stable energy supply and minimize world market impacts on energy costs.

7. Renewable energy development will serve to decrease the nation's dependance on foreign oil.

8. While Western coal plants do not have the same SO_2 emission problems of their Eastern counterparts, future acid rain legislation could add dramatically to the uncertainty of future coal plant prices. Geothermal units may be considered more environmentally sound.

SIERRA'S PLANS

Before the liquid dominated geothermal resources in Nevada can reach the full development stage utilities must have answers to questions on resource development, conversion technology and economic benefit. The answers can best be demonstrated through a pilot program. Sierra plans to do exactly that.

To assess the technical and economic questions surrounding hot water resources, we have completed negotiations with three developers to deliver 24 MW of Nevada geothermal generation from three separate resources, using three different technologies. These pilot projects will provide Sierra with detailed resource, technology, and cost data.

Sierra determined that three separate projects at different resources would be most practical. The developers will be responsible for resource development and plant construction and will sell electrical energy to Sierra if they are successful. Sierra will only pay for energy delivered. Successful development could save the equivalent of more than 100,000 barrels of oil annually.

With this arrangement, both the costs and risks to Sierra ratepayers and stockholders are minimized.

REGULATORY SUPPORT REQUIRED

The three pilot contracts require Nevada Public Service Commission approval of the pricing provisions to be included as a portion of our purchased power costs. The request for Commission action was filed in late February. We have emphasized the importance of expeditious treatment as the developers must get under way shortly in order to be able to deliver energy and take advantage of the Federal Energy Tax Credit.

The tax credit, an important key to encouraging geothermal development, is scheduled to expire at the end of 1985 unless Congress acts to extend the program. The benefits of this tax credit will be passed on to rate payers in the contracts signed by Sierra. If Nevada Public Service Commission action doesn't occur shortly, the developers may not be able to meet the tax credit deadline, project economics will deteriorate, and development may not occur.

FURTHER DEVELOPMENT

Sierra is supportive of further development occurring for the benefit of the geothermal industry and other utilities. However, Sierra's ability to export energy to other utilities is restricted by a lack of transmission capacity. To allow further development, we are actively working with Southern California Edison Company (SCE) and eight geothermal developers to provide a transmission path to Southern California. The developrs are prepared to fund an intertie with at least a 50 MW capability. The map I have provided today shows Sierra's transmission system and one possible route for this new intertie.

CONGRESSIONAL SUPPORT

We have identified five key areas of that could use Congressional support in order to advance geothermal development.

1) Geothermal Lease Expiration - Many Federal leases are close to expiration without adequate production to hold ownership. Consideration should be given to extending these leases based on an adequate demonstration of activity and need as it appears that the industry is on the verge of producing results from its development work.

2) Energy Tax Credit Extension - The ETC plays a key role in encouraging development. However, as currently structured there is no guarantee that the consumers paying the higher costs of early development will benefit other than through the negotiating process. No new legislation should be enacted to extend the ETC that would limit a utility's ability to negotiate for the purchase of geothermal generation.

3) Utility Restrictions - Currently, utilities cannot own greater than 49% of a small power production facility and have the project receive the tax credits otherwise available. This restriction discourages utilities from investing in geothermal facilities for the benefit of its customers. A regulated utility requires a lower rate of return than venture capital, thus full 100% ownership should be permitted as a means of reducing costs to the ratepayer. Utilities should also be allowed to recover early development costs and lease costs in rates in order to obtain future resource positions at the lowest possible cost.

4) Use of Transmission Facilities - To the extent existing transmission facilities are used to move geothermal power, a utility may forego the ability to sell or purchase lower cost energy. Developers should retain full responsibility for the costs for transmission additions. Utilities should not be required to forego economy purchases and sales in order to move alternative energy.

5) Development Incentives - One method of encouraging further development would be to allow utilities to recover higher than average system costs in rates for pilot or demonstration plants.

CONCLUSIONS

It is my belief that Sierra is responding to the country's need to reduce fossil fuel dependency by actively encouraging geothermal development. We are attempting to accomplish this by taking a longer term view of future resource needs, and by supporting demonstration plants now. Regulators and the public sector must take a similar position, as diversification offers the best method of controlling future energy costs.

Thank you for the opportunity to present Sierra's views.

Senator HECHT. Thank you very much.

Mr. Ed Myers, vice president, systems development, Southern California Edison Co., from Rosemead, CA.

STATEMENT OF EDWARD A. MYERS, JR., VICE PRESIDENT, SOUTHERN CALIFORNIA EDISON CO.

Mr. MYERS. Good afternoon, Senator. All of us appreciate the thoroughness with which you and your staff are conducting these hearings.

Early on I guess Southern California Edision has been identified as the marketplace or the major marketplace in California for many geothermal developments, including the one in Nevada. We certainly agree with that characterization of our system.

We serve over nine million people in Southern California, over 50,000 square mile service area, which includes central and southern California.

In October 1980, we committed ourselves to the accelerated development of alternate and renewable generating technology. Except for major plants now under construction, all of our additions between now and 1993 are planned to be generation resources that are alternate and renewable, including wind, solar, biomass, hydroelectric, cogeneration, and of course, geothermal.

Despite the fact that our current reserve margins are considered by some to be more than adequate, we have continued executing contracts for alternate and renewable energy, with third-party entrepreneurs, and at the moment we have over a thousand megawatts under contract from alternate and renewable.

Our goal for 1993 is 2,200 megawatts, of which at least 350 megawatts would be or expected to be geothermal.

Most of the potential geothermal is external to our service territory. Therefore, in order for us to pursue this technology, we have had to extend our interest to adjacent areas, including Mexico, where we have concluded a long-term power purchase with Mexico, the Imperial Valley of California, and our negotiations with Nevada developers.

Unfortunately, there is a real bottleneck in the transmission capability in order to get it into our system.

The town of Bishop has been mentioned as the nearest point here. I'd point out that that is maybe 300 to 500 miles, depending on where you are developing in northern Nevada, to get to our control substation in Bishop, and from there south we have a limited transmission capability that would have to be reinforced in order to take large quantities such as are being mentioned here.

We have applied PURPA principles. I think the California commission has been thoroughly supportive of the idea of PURPA, and we do have long-term firm offers that do recognize the long-term avoided cost of major plants as has been mentioned here today, which makes our avoided cost a lot more attractive in the short range, at least to developers.

However, under PURPA, the developer is obligated to supply the interconnection to our system, which is one of the problems that we are having. We have been cooperating with Sierra Pacific, as Mr. Jones said, in trying to amalgamate some kind of interconnection, but one of the things that concerns us is, as you have heard today, there are at least two plans by the developers to try to get into the California market. That really doesn't make much sense.

We hope that there can be a unified approach to a single transmission route that is adequate to develop all of the potential resources up here. As I say, we have a large need, and we are power providers.

There is a gap between the research and development. We have done a lot of it in the Imperial Valley where we own and operate powerplants with geothermal resources served by others. We have about 166 megawatts now under contract from the Imperial Valley. So, we are very serious about the geothermal business.

I think that everyone has talked enough about the need to extend the tax credits. We certainly support that, sir.

And I thank you kindly for your attention in listening to our story.

[The prepared statement of Mr. Myers follows:]

STATEMENT OF
EDWARD A. MYERS, JR.
VICE PRESIDENT
SOUTHERN CALIFORNIA EDISON COMPANY

I would like to thank the Committee for the invitation to appear today and to commend the Committee on its interest in the development of geothermal resources.

Southern California Edison is an investor-owned electric utility serving 3.3 million customers in a 50,000-square-mile area of central and southern California.

In October 1980, Southern California Edison made a major commitment to the deployment of alternate and renewable electric power generating technologies. Except for plants now under construction and some power purchases from other utilities, all of Edison's projected additional generation resource needs in this decade are planned to be supplied from alternate and renewable technologies--including wind, solar, biomass, hydroelectric, cogeneration, and, of course, geothermal.

Edison's current goal for alternate and renewable resource additions by 1993 is about 2,200 megawatts, of which at least 350 megatwatts is expected to be derived from geothermal plants. It is also expected that the majority of these goals will be met by way of power purchases under PURPA-type arrangements with independent developers.

Various surveys and studies have indicated that there is vast potential for geothermal energy development in the Nevada-California region. Most of this potential is external to Edison's service area. Therefore, in order to pursue this technology, Edison has extended its interest to adjacent areas, including Mexico, the Imperial Valley of California, and Nevada.

Also, since most of the known geothermal resource areas are found in relatively remote locations with respect to existing services, including major electric transmission facilities, this has necessitated cooperative efforts on the part of the local utilities, the geothermal developers, and Edison.

Because Edison is still quite dependent on expensive oil or gas power plant fuels for a large proportion of its energy, the prices Edison can pay under PURPA principles for electricity purchases from independent developers is typically higher than utilities in neighboring states. This often makes Edison a desirable market and helps make some projects economically viable when measured against the PURPA test.

Edison presently has firm arrangements to buy electric power from a geothermal project in Mexico, and under PURPA-type contracts from five projects in the Imperial Valley and two projects in the Mammoth Lakes areas of California. In addition, Edison has constructed and operates in conjunction with the geothermal energy supplier two 10-megawatt pilot power plants in the Imperial Valley.

As a supplement to the involvement with geothermal development in California, Edison has been cooperating with Sierra Pacific Power Company and potential geothermal developers in Nevada concerning possible projects in such areas as Beowawe, Dixie Valley, Brady Hot Springs, Steamboat Springs, and Fish Lake Valley.

Edison is and has been willing to consider purchasing power from these projects under PURPA-type arrangements. However, since Edison presently has no operating interconnections to these areas or with Sierra Pacific Power Company, a prerequisite is determination of realistic means and cost responsibility for transmitting any power to Edison's load center which is 300 to 500 miles away. Sierra Pacific Power Company and the project developers are integral to this effort. Edison believes this effort is progressing on a constructive basis as rapidly as practical.

With respect to efforts needed in the public sector, it is important to recognize that we are not dealing with an off-the-shelf technology. There exists a gap between the completion of the R&D phase and the commercialization phase for geothermal and other emerging energy technologies. Edison believes that the Federal government should ensure that a smooth transition for commercialization by the private sector is provided at the completion of the R&D phase. The Federal government can provide valuable assistance to industry by taking favorable action on extension and enhancement of Business Energy Tax Credits. Without the existence of these tax incentives, the Federal government would not be able to maximize the potential return on its prior research expenditures, and the commercial availability of these technologies may be significantly delayed, if not denied.

Thank you again for the opportunity to appear before this Committee.

Senator HECHT. Thank you very much.

Mr. Lee Keilman, manager, Nuclear Engineering Department, Sacramento Municipal Utilities District, Sacramento, Calif.

STATEMENT OF L. R. KEILMAN, MANAGER, NUCLEAR ENGINEERING, SACRAMENTO MUNICIPAL UTILITY DISTRICT

Mr. KEILMAN. Yes, sir. I want to thank you for inviting us over to give testimony.

SMUD has built in the Geysers 72-megawatt geothermal unit of our own that came online last year and was put into commercial operation.

Since that time it's been running at a plant capacity factor of over 90 percent. The power costs out of that unit is something less than 5 cents.

SMUD is a strong supporter of geothermal openings for generating electric power. We, in 1983, signed an agreement for steam rights for 60,000 acres of geothermal rights in the Geysers.

I'd like to give you a little bit of history now to collaborate the work that the utilities have done in northern Nevada in cooperation with Sierra Pacific Power Co., Eugene Water Electric Board, Portland General Electric, Pacific Power & Light, and SMUD.

In 1978, we started a program to look at the resource over here in northern Nevada. I'd like to show you slide No. 1. Bear with me on some pictures. Being an engineer, I talk better with pictures.

We had an outside consultant look at the various reservoir data that was available. We studied in depth the Beowawe Reservoir, Dixie Valley Reservoir and the Desert Peaks Reservoir. The consultant rated all of these reservoirs as potential for development.

Truly, the greatest potential in his opinion was Dixie Valley, as the hottest down-hole water temperatures, as the greatest potential at that time. Somewhere from 500 to 700 megawatts was his estimate.

Part of our effort as a joint utility group, we looked at all the various cycles to developing power over here in northern Nevada from hot water reservoirs. We looked at both double, single flash, binary, total flow, et cetera.

In 1981, we formed a company, the NORNEV Geothermal Generation Demonstration Co., thereafter known as NORNEV.

We contracted and signed a letter of intent on the Beowawe Reservoir. This next slide, I'd just like to briefly show you the cycle that we opted for was a modular type. Most economical we could find. It could be fabricated in the shop, shipped to the site, thus reducing high construction costs.

The concept was to down-hole pump it through heat exchangers, back down into the ground, environmentally sound.

Here in Nevada we got a construction permit. I think the time was something like 90 days. Unheard of in California.

Went on in this project until mid-1982, and looked like it was going to go, and the developer wanted to back off of funding the project, and that was the first domino that fell.

After that things went downhill. Bonneville Power Administration removed their support of the two organization utilities, and thus make less incentive for them to proceed.

Anyhow, the project is now on hold. NORNEV itself, my understanding, is still an entity until 1985, or until the four of us utilities so vote to abandon it.

My estimated cost for online, and it would have been 1983, was 8 cents for this plant. Truly subsidized.

At that time SMUD was willing to subsidize the development of first unit with the hopes that subsequent unit of larger size would be more economical and closer to the cost of coal plant here in the west.

I was asked to comment briefly on the market in northern California. I think there is a market for geothermal energy in northern California. If the price is right SMUD would certainly buy it, if we could get it to our system.

Quite frankly, it is going to have to be somewheres around that 5 to 5½ cents. We could not subsidize 50-, 100-megawatt units.

How to promote geothermal development here in Nevada, as SMUD sees it, I'd like to show you my third slide. Sierra Pacific and SMUD have completed a joint study, feasibility study, showing that there is seven alternate routes to bring power to south of Tahoe, Carson City there, over to the SMUD transmission system. That route, the longest route I think from the south side is some 70 miles of transmission line.

We are into writing the environmental report. With enough support from Federal agencies, State agencies, we think that that line could be completed in 1988. We request the support of everyone to help build that line.

We looked at seven options. Another option is to come down Highway 80. Now, that option is some 125 miles, as I recall. Quite a bit more cost. The costs of this transmission line vary from some $30 to $70 million.

We think that to kick off the three promising reservoirs in Nevada, we probably don't support this shotgun approach or try to develop all the reservoirs at the same time. But those three most promising ones for sure the development has to start with the 10-megawatt unit, has to be subsidized by someone. That is our feeling. And even maybe up to the first 50-megawatt unit.

We were happy to hear this morning that there's been a change in the Nevada State law on recapture of natural resources. Before making a conclusion on that, we'd have to read that law.

Previously that was restrictive for any California utility to develop jointly resources in Nevada, either coal or geothermal. I want to thank you for listening to me today.

[The prepared statement of Mr. Keilman follows:]

Date: April 17, 1984

TESTIMONY for

Senate Subcommittee on Energy and Mineral Resources -
Geothermal Resources in Nevada - Chairman Senator Chic Hecht.

STATEMENT

The following are my opinions on and understanding of the development of hot-water Geothermal-Electric Power Plants in Northern Nevada

By: LRKeilman
L. R. Keilman, Manager of Nuclear Engineering
Sacramento Municipal Utility District (SMUD)

CREDENTIALS:

Mechanical Engineering Degree;

Masters Degree in Business Administration;

Twenty-four (24) years experience in the design, construction, and operation of utility electric power plants; for five (5) years Project Manager for SMUD's 72 megawatt (MW) geothermal unit in the Geysers; SMUD's representative to the NORNEV Joint Utility Group.

HISTORY:

I. GEOTHERMAL DEVELOPMENT IN NORTHERN NEVADA

A. Phase A - Study Efforts

The NORNEV project had its beginning in early 1978 when five utilities -- Eugene Water and Electric Board (EWEB), Pacific Power and Light (PP&L), Portland General Electric (PGE), Sacramento Municipal Utility District (SMUD), and Sierra Pacific Power Company (SPPCO) began discussing the feasibility of constructing a 50 megawatt (MW) geothermal flash steam plant on a yet to be determined northern Nevada site. This region has long been recognized as an area of considerable geothermal potential.

After a year of informal but earnest activity, the utilities entered into a "Phase A" agreement in May 1979, to commit up to $100,000 each to finance a defined program that would look into a geothermal resource evaluation of various sites; the development of a conceptual generating plant design, together with cost estimates; a review of State/Federal statutes relating to construction and operation of commercial geothermal power plants; and investigation of funding sources including possible Federal assistance.

While the Phase A project effort continued, two new developments took place. First, it was becoming increasingly apparent that some of the resource producers were not sufficiently confident of their respective Nevada resources to embark upon large scale drilling operations (20 to 30 deep wells for a 50 MW plant) until they learned more about the geology of the strata they were working in. All agreed that hydrothermal development in Nevada's relatively unknown "basement rock" formations was considerably different from the well defined dry steam reservoirs at the Geysers area in northern California.

The second development was to consider a newly designed 10 MW binary plant that called for factory fabrication of transportable modules ready for site installation on concrete pads. This concept as shown in Figure 1 offered a number of advantages: first, its cycle efficiency was presented as being at least equivalent to that of larger steam "flash" plants; second, in the event a geothermal resource failed or declined, it was possible to disassemble the modules and relocate the plant; and third, the binary technique, coupled with air condensor cooling and reinjection of geothermal fluids, minimized air and ground water pollution. Since the geothermal fluids would be totally encased during their passage from the production wells through the plant thence back into the ground through reinjection wells, neither the ambient air nor the groundwater geochemistry would be affected. Essentially, only the BTUs were extracted. Environmentally, everything else would stay the same.

Geothermex of Berkeley, California, made a detailed study of the Desert Peak, Dixie Valley, and Beowawe hot water geothermal reservoirs. The locations of these reservoirs are shown in Figure 2. Dixie Valley had the hottest bottom hole temperatures, 460°F plus, while Beowawe the lowest at 325-360°F. The Beowawe reservoir was selected because of the short electrical transmission line required and the receptiveness of the brine supplier to enter into a development-type geothermal brine supply contract.

B. NORNEV Company

In 1981, the group entered into the second phase of the project and formed the official company NORNEV Geothermal Generation Demonstration Company (NORNEV), a company under Oregon state law. Also, the geothermal industry started referring to the group as NORNEV. NORNEV then authorized the detailed design study for a 10 MW geothermal-isobutane binary cycle unit to be located on the Beowawe Reservoir and a letter of intent to locate the unit on the Beowawe reservoir. The small 10 MW binary unit offered many unique features.

C. Plant Description

The following is a description of the proposed 10 MW plant:

The 10 mw binary unit will be contained in a fenced facility area approximately 500' x 500'. Figure number 1 shows a simplified cycle diagram of the power conversion cycle. The cycle, as built, will have an economizer heat exchanger to improve cycle efficiency.

The plant is sized for a gross generating capacity of 13 MW's. The plant auxiliary load will vary, but the plant is sized for 10 MW's net. Power supplied for brine supplier's onsite loads in exchange for geothermal heat reduces the net saleable energy to about 8 MW's.

Eleven modules and the air condensor assemblies will be trucked to the site.

Individually packaged on four separate skids will be an air compressor section, fire protection equipment, an electrical switchgear and motor control center module, and a lube oil/seal oil section.

One module will include a solids separator complete with valves, piping, and instrumentation for control of the geothermal fluid input coming from the producing wells.

Two modules, each expected to contain seven shell and tube heat exchangers 44 feet long and 3 feet in diameter arranged for parallel flow, will be connected in series and contain all necessary piping, valves, and instrumentation. Each of these modules will measure 44 feet x 12 feet.

Another module will include an economizer section of two shell and tube heat exchangers that will reclaim surplus heat exiting from the turbine-generator and use it to preheat the liquid isobutane passing from the air coolers to the main heat exchangers.

The turbine-generator module will include a turbo-expander with speed decreasing gear and a 1200 rpm TEFC 4160 V. generator rated at 13 megawatts.

The electrical switchgear, synchronization panel, a solid state microprocessor control panel and other related control equipment will be packaged in a control module.

Another module will include a 24,000 gallon isobutane (IC_4) storage vessel and a 15,000 gallon, 250-lb. pressure, nitrogen vessel with piping, valves and controls.

Additionally, there will be an air condensor yard area (110' x 180') for cooling the isobutane working fluid after it has passed through the turbine-generator. This area will include 34 pre-fabricated aerial coolers complete with inlet and outlet header sections, piping, valves, blow-down system, and two-speed electric motor driver fans.

Detailed design drawings and specifications were produced and are still available for use if the NORNEV group decides to reactivate the project.

D. Project Schedule - 10 MW Binary Unit

The original goal was to have the 10 MW unit on line in 1983. However, in mid-1982, the brine supplier stated that they had cash flow problems, and wanted to defer drilling any wells until 1983. Following that, there was a setback to the project when the Oregon utilities were not given the financial support they had expected from the Bonneville Power Administration. During the first quarter of 1983, the project was put on an indefinite delayed status.

II. PRESENT STATUS - APRIL 1984

A. NORNEV

The NORNEV Geothermal Generation Demonstration Company is still a functioning entity and the utility members have agreed to maintain it as such until December 1985 at which time the group will decide whether to dissolve the Company.

B. Trans-Sierra Transmission Line

Sierra Pacific Power Company (SPPCO) and SMUD have completed the feasibility study phase and have already started the licensing phase for building a high voltage transmission line across the Sierra mountains. This line would run south of Lake Tahoe and interconnect (SPPCO) electric transmission grid to SMUD's grid. The area for proposed corridors for transmission line is shown in Figure 3. A tentative date for completion of this line is 1988. The purpose of this line is to provide a means for SMUD to buy and sell electric energy and capacity to (SPPCO) and other utilities that are interconnected to (SPPCO).

SMUD expectations for power interchange over the Trans-Sierra Line include electric power generated from both coal fired electric power plants and other potential sources such as hot water geothermal energy from northern Nevada. However, the geothermal power generating plants must be cost competitive with coal fired power plants located in this same area or from power purchases outside this area.

III. GEOTHERMAL POWER MARKET POTENTIAL IN CALIFORNIA

During the month of April 1984, SMUD, as the lead agency acting for the Central California Power Agency (CCPA), will submit to the California Energy Commission an Application For Certification requesting a construction permit to build a unit in the Geysers. CCPA has contracted for additional steam resources in the Geysers with an estimated development potential of at least 500 MW. It is felt that our base load plant development for at least the next ten years can be met by these resources in the Geysers.

Our Resource Planning has identified that for short term planning (6-10 years), we should put more emphasis and priority on obtaining peaking power resources in order to meet our high system peak which occurs in the summer time. For long term (greater than 10 years), SMUD will need additional base load resources. It is my opinion that the geothermal resources, both dry steam and hot water electric power conversion cycles, will not be feasible (for technical reasons) for power peaking type operations. However, joint development with utilities that have winter time peaking systems would make northern Nevada hot water geothermal attractive if the price is competitive to that of coal plants.

There are presently no electric utility owned coal fired power plants in the state of California and no favorable regulatory indications that one could be built in the future.

It is also doubtful that significant oil or gas fired generating units greater than 50 MW could be licensed. If the regulatory environment doesn't change, it is my opinion that California utilities will have to look to out-of-state resources to meet future load growth. These resources could be either coal or geothermal powered. To utilize northern Nevada geothermal resources in the central valley of California, a Trans-Sierra high voltage transmission line must be built. Furthermore, it is my opinion that northern California utilities will not commit to any geothermal power plants in northern Nevada until there is a construction permit issued for such a transmission line.

IV. HOW TO ACCELERATE GEOTHERMAL DEVELOPMENT IN NORTHERN NEVADA

A. Power Conversion Technology and Reservoir Development

The five years of work done by NORNEV has shown that there are enough unknowns in both the development of the geothermal power conversion technology and identification of reservoir potential that small units of 10 MW size must first be proven on each reservoir. It is my opinion that these first small units will not be cost effective. In fact, that was the case for the 10 MW binary unit proposed by NORNEV. My estimate of on line costs (1983 base) for that NORNEV unit was 8 cents per kilowatt hour, clearly not cost effective and requiring a form of subsidy to develop the unit.

It is my feeling that some form of cost incentives, cost support or special electric rate adjustments must come from government agencies to accelerate geothermal plant development in northern Nevada. The small plants must lead the way to the development of commercial 50 to 100 MW size plants that are cost competitive to coal. Ideally, the United States Department of Energy would co-fund the development of the first 10 MW unit and a subsequent 50 MW unit for both construction costs and the first five years of operation on all three of the reservoirs noted earlier.

B. Transmission Lines

In order to sell or interchange geothermal power between California and Nevada, new transmission lines are required. To accelerate the licensing of such lines over the Sierra mountains, the support and cooperation of Federal, State and local government agencies is necessary.

A statement by the Federal Committee of Energy and Natural Resources that such transmission lines are needed and should be built would certainly help accelerate the licensing process.

C. Nevada Recapture

Developing power plants in Nevada involves power recapture provisions. Pursuant to Nevada law, each out-of-state utility that develops or shares in the development of natural resources in Nevada must allow provisions in the plant contract for Nevada utilities to claim 50% of the output of any generating plant. This is a real problem for out-of-state utilities and Nevada lawmakers should take another look at this law if they want to promote the development of geothermal generating plants in Nevada.

FIGURE 1

NORTHERN NEVADA TYPICAL BINARY CYCLE

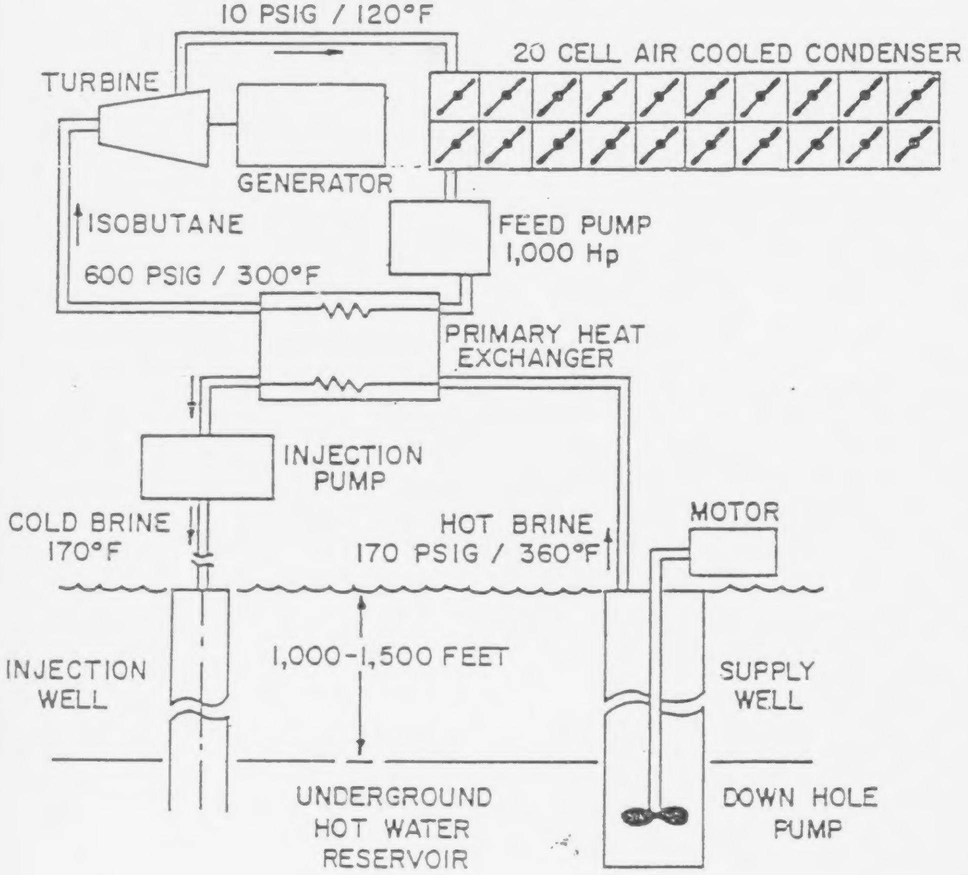
10 PSIG / 120°F
20 CELL AIR COOLED CONDENSER
TURBINE
GENERATOR
ISOBUTANE
FEED PUMP
1,000 Hp
600 PSIG / 300°F
PRIMARY HEAT EXCHANGER
INJECTION PUMP
COLD BRINE
170°F
HOT BRINE
170 PSIG / 360°F
MOTOR
INJECTION WELL
1,000-1,500 FEET
SUPPLY WELL
UNDERGROUND HOT WATER RESERVOIR
DOWN HOLE PUMP

FIGURE 1

FIGURE 2

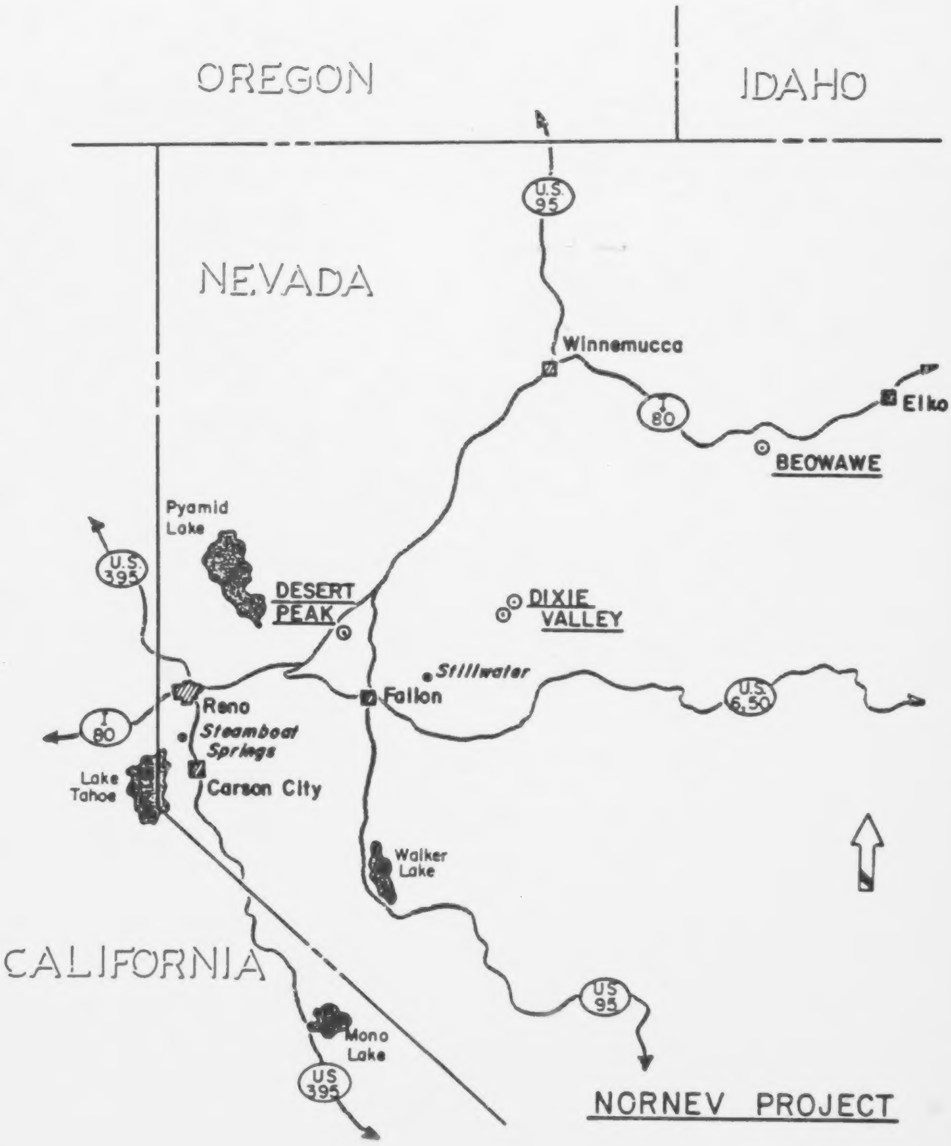
OREGON
IDAHO
U.S. 95
NEVADA
Winnemucca
80
Elko
BEOWAWE
Pyamid Lake
U.S. 395
DESERT PEAK
DIXIE VALLEY
Stillwater
Reno
Fallon
U.S. 6,50
80
Steamboat Springs
Lake Tahoe
Carson City
Walker Lake
CALIFORNIA
US 95
Mono Lake
US 395
NORNEV PROJECT

FIGURE 2

FIGURE 3

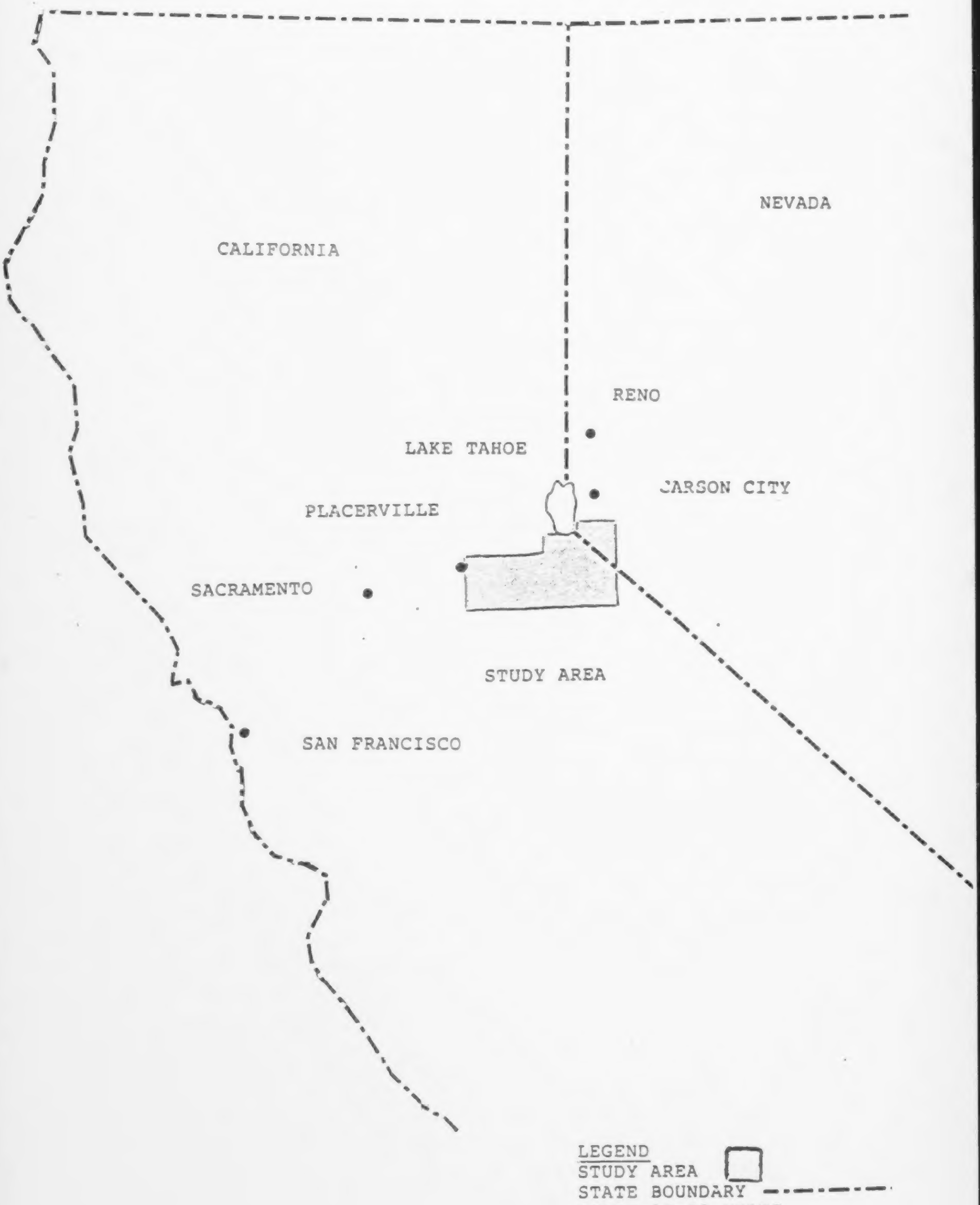
NEVADA
CALIFORNIA
RENO
LAKE TAHOE
CARSON CITY
PLACERVILLE
SACRAMENTO
STUDY AREA
SAN FRANCISCO
LEGEND
STUDY AREA
STATE BOUNDARY
SCALE 1"=50 MILES

FIGURE 3

Senator HECHT. Thank you very much.

Each of you seem to agree that we need to build transmission lines to California if we are to find a near-term market for Nevada's geothermal power resources.

Mr. KEILMAN. Yes, sir. I think the most vocal person is suggesting that we build that 70 million transmission line underground. To do that would be surely impossible from an economic standpoint. He bases that on the esthetic nature of that said transmission line.

Senator HECHT. Mr. Keilman, you have stated that as far as SMUD is concerned, Nevada's geothermal power must be priced competitively with coal. You also say that coal plants cannot be built in California for regulatory and environmental reasons.

In 1983 dollars, what do you project the price of Nevada's coal-generated power to be?

Mr. KEILMAN. From a coal plant, which we were a potential partner to, we were carrying a number in 1982 of 1,600 kilowattage dollars.

Senator HECHT. Is there a premium one might attach to geothermal power because its fuel cost component hot water is relatively stable?

Mr. KEILMAN. Each one of those contracts we have looked at have various escalation clauses built into them. So, the tradeoff is that the escalation for geothermal resources, brine supplies, are about the same as coal.

Senator HECHT. Mr. Myers, you have stated that in order to build a transmission intertie with Edison's service territory cooperation is needed between the private developers and Sierra Pacific Power Co.

Would each of you care to summarize the various economic or regulatory constraints that you feel may impede the construction of these transmission lines before, say, the end of the decade?

Mr. JONES. Probably the main hurdle we are going to have to go over is just the financing of the transmission facility itself.

However, the primary problem at this point is the obtaining a permit from the U.S. Forest Service for crossing the Sierra-Nevada mountain range. That is very sensitive environmentally.

We have been encouraged because the Forest Service has taken a look at the corridor concept that we have been pushing for some time. They have recognized that they must provide for some future crossing of the Sierras, and right now it is a matter of how long it is going to take to boil down the alternatives and come up with an acceptable route for a transmission line.

Senator HECHT. Do you, or Mr. Keilman, do you anticipate a great deal of environmental trouble in trying to build a trans-Sierra powerline south of Lake Tahoe or anywhere else?

Mr. JONES. Yes, I do, particularly south of Lake Tahoe.

Senator HECHT. Mr. Keilman.

Does your company have any economic incentive to interconnect with Sierra Pacific absent your interest in geothermal power?

Mr. MYERS. Well, I think that first we do have an interest in the geothermal power. But we also have an interest beyond the geothermal power, which is why we would like to see the interconnection to be adequate to do the total job.

We don't think somebody building a line to bring 10 megawatts down does anybody any good. On a pro rata we have estimated about 150 million dollars' worth of transmission lines to be built over time is the economic point at which the access to the geothermal fields can be maximized and the purchase opportunities beyond.

But we think it really should be to an interconnection with the Sierra system because if it just goes to a geothermal field, that is the only value that would attach to the line.

Senator HECHT. Mr. Jones, do you have anything to add to this?

Mr. JONES. No. We certainly support the interconnection. We feel there are some additional benefits, and those should be evaluated in arriving at a mutual agreement.

Senator HECHT. Mr. Jones, what incentive does your company have to financially participate in the construction of a transmission line to southern California?

Mr. JONES. From a regulatory viewpoint, cost, capital cost viewpoint, absolutely zero.

Looking down the road from a future potential of increasing imports to our system, it potentially could have a savings to the company, to the consumer, in that we'd be able to purchase more economy power out of the Northwest, wherever it becomes available, that that purchase of economy power the way it is handled ratewise, flows directly to the ratepayer. So, from a corporate point of view, it is really questionable.

Senator HECHT. Do you see any other potential market for Nevada's geothermal power to the north or east of your present service territory?

Mr. JONES. As I mentioned earlier, to the north we are looking at excess hydro. Coal-based generation supplements that. You are looking at costs in the 1½-cent, 2-cent range. Geothermal certainly cannot compete with that.

Nevada Power, I also believe, has substantially lower costs of generation today. Although, their avoided cost is higher. But that is a 400-mile transmission line to go through Nevada Power. I believe the primary market has to be California.

Senator HECHT. Thank you very much. Thank you, gentlemen, very much.

Panel No. 6, would you please come forward?

Mr. Thomas Flynn, research associate, geologist, Division of Earth Sciences, University of Nevada, Reno, Nev. Mr. Flynn.

STATEMENT OF THOMAS FLYNN, GEOLOGIST, DIVISION OF EARTH SCIENCES, UNIVERSITY OF NEVADA, LAS VEGAS

Mr. FLYNN. Mr. Chairman, members of the committee, ladies and gentlemen, on behalf of the University of Nevada, Las Vegas, and the division of earth sciences, I'd like to thank you for the opportunity to appear today and present testimony concerning geothermal energy development and utilization in the State of Nevada.

The next few minutes I will briefly describe the nature of geothermal research programs completed by the division of earth sciences, principal areas of direct utilization of geothermal resources throughout the State, recommendations submitted to the U.S. Department of Energy for geothermal research and development, the effect of IRS Revenue Ruling 81-304 on geothermal development, and finally, present and proposed geothermal research programs.

The division of earth sciences is affiliated with the Environmental Research Center, University of Nevada, Las Vegas, and consists of a group of geologists, geochemists, and engineers. It began operation in our Reno office in April 1981.

The division of earth sciences is the principal geothermal research group in the State of Nevada. Under the direction of Dennis Trexler, the group has completed statewide assessment programs, and several regional exploration and reservoir confirmation studies. The most recent publication is a color map entitled "Geothermal Resources of Nevada." It was prepared in connection with the U.S. Geological Survey, the National Oceanic and Atmospheric Administration and was funded by the U.S. Department of Energy, Division of Geothermal Energy.

DES is supported entirely by Federal grants and cooperative agreement with the U.S. Department of Energy, and its primary function is to perform geothermal resource assessment work and to promote direct utilization of geothermal energy throughout the State.

The major contributions of the members of this group include: A 1979 map entitled "Geothermal Resources of Nevada and Their Potential for Direct Utilization." This map showed the location of more than 300 geothermal springs and wells, presented technical data for geothermal resources, and evaluated resources areas on the basis of technical and economic parameters.

This map laid the groundwork for subsequent area specific studies. These investigations included geologic, geochemical, and geophysical surveys and were performed from 1980 to 1983 in the following areas: Carson-Eagle Valley, Big Smokey Valley, Caliente, Hawthorne, Fallon, Paradise Valley, Pumpernickel Valley, and Carlin.

In particular, this map successfully delineated shallow-depth reservoirs, which are technically capable of supplying sufficient heat and hot water to municipal space heating districts.

Our most recent work also includes a reservoir management program completed in the Moana area of southwest Reno. Moana is the largest geothermal development area within the State of Nevada. A minimum of 150 shallow wells supplying heat and hot water to more than 200 homes, 2 large motels, and several churches.

An estimated $5 to $7 million, all privately funded, has already been invested. Our program was designed to determine the geologic characteristics of the reservoir and to make recommendations for prudent resource development.

The map behind you updates our 1979 map and lists data for more than 900 geothermal springs and wells throughout the State. This alone reflects the dramatic increase in geothermal development in Nevada.

In addition to the Moana area, there are various other applications of geothermal fluid utilization throughout the State, which I don't have time to get into, but these locations include: Wabuska, Duckwater, Carson City, Brady's, and Mr. Shelly Gordon will discuss Elko, I believe.

In addition, Steamboat, Carson, and Walley's Hot Springs offer some of the best in Balenology in the West.

In March 1984, at the request of the U.S. Department of Energy headquarters staff in Washington, D.C., a list of recommendations for geothermal research and development in Nevada was submitted. These suggestions were based on experience with previously funded U.S. DOE programs, the historical development of geothermal resources in Nevada, and anticipated research and development programs required to ensure prudent development.

These recommendations include:

Maintenance of the statewide assessment program to collect and disseminate resource data;

Developing a cooperative agreement with Nevada's mineral industry to use geothermal fluids in heap-leaching operations;

Establish a federally funded direct assistance program to local governments for construction of municipal-operated geothermal space heating districts. Moneys would be used to construct the major portions of the fluid distribution system. Municipalities would be required to return a portion of moneys saved to a State fund which could be reinvested to geothermal projects throughout Nevada. Hawthorne, Caliente, and Wells are three areas that may benefit from such a program.

Mr. Chairman, you expressed an interest in regulatory problems that could impede geothermal development in Nevada.

It is a rare occasion when we can point to one Federal regulation that clearly straddles the path of our progress toward energy independence. It is an equally rare occasion when the solution to such an institutional barrier is simple to accomplish.

The Federal regulation in question is the Internal Revenue Service Ruling 81-304, which prohibits the use of residential geothermal tax credits for fluids with a temperature less than 50 °C or 122 °F. The solution to this obstacle is abolition of this arbitrary ruling which has no basis in scientific fact.

The State of Nevada has more than 900 geothermal springs and wells. In this case, geothermal refers to fluids with temperatures of 20 °C or above.

This temperature reflects the standard of the U.S. Geological Survey, which defines a geothermal anomaly as a fluid temperature of 10 °C above mean annual air temperature. In addition to temperature, chemical composition and proximity to geothermal areas should be considered.

A geothermal reservoir is a complex geologic structure that may exhibit a wide range of temperatures. The geothermal reservoir does not begin nor end on the basis of the arbitrary limit now imposed by the IRS. No similar ruling exists for solar or wind-power technology.

This ruling has already had a devastating effect on Nevadans. Mr. M. Crawford of Reno was recently denied a residential energy tax credit because a geothermal well that he and a neighbor use to heat their homes has a reported temperature of 121 degrees Fahrenheit. That is 1 degree below the legal limit.

Another resident of Reno, Mr. D. Warwick, was originally granted a tax credit for his 88° geothermal well. The IRS now claims that on the basis of this postfacto ruling, Mr. Warwick must return the tax credit to the IRS.

Based on the IRS ruling, nearly 20 percent of the present users would be excluded from claiming geothermal energy tax credits because their geothermal wells are, according to the IRS, not geothermal.

At the present time, there are two bills stalled on the floor of the Senate and House of Representatives. Those bills are intended to remove bureaucratic hurdles associated with the arbitrary definition of geothermal now enforced by the IRS.

The major opponents of these bills cite the growing Federal deficit and claim that extending the tax credit to include groundwater heat pumps threatens the resolution of the national problem. Frankly, I believe that reducing oil imports by utilizing more domestic energy resources, including geothermal, will reduce the flow of money to the Middle East.

Recent work completed by the U.S. Department of Energy and the U.S. Geological Survey indicates that vast areas of the United States, including Nevada, are underlain by low- to moderate-temperature geothermal resources. if the present IRS ruling is allowed to stand, much of this resource will remain undeveloped.

Successfully locating an economically usable resource is an inherently risky business. Direct utilization of all geothermal resources does represent a step toward decreasing our dependence on imported oil as well as reducing combustion of fossil fuels for home heating.

Considering the smog problem in the Truckee Meadows, and elsewhere in the United States, every little bit helps. The IRS ruling adds a burden that is unnecessary, unscientific, and unwarranted. I urge you to support legislation aimed at the abolition of IRS 81-304.

Finally, the Division of Earth Sciences and the California Division of Mines and Geology are currently cooperating on the baseline data acquisition phase of a project to investigate reservoir characteristics and geothermal fluid genesis associated with magmatic activity in eastern California and western Nevada. The joint geologic program is being funded by the U.S. Department of Energy and represents a spirit of cooperation between these two States that has not been previously attempted.

Magma represents the ultimate geothermal resource, and preliminary studies indicate that it is technically feasible to drill into and recover steam from shallow magma bodies.

The Division of Earth Sciences has recently submitted a proposal to conduct geologic field surveys and moderate-depth exploration drilling in the Long Valley, Aurora Craters area.

The goal of this research is to locate favorable sites for the drilling, completion, and testing of a very deep drill hole, 20,000 feet. The target for this hole will be a shallow magma body, several of which are believed to be located within the study area.

The goal of this study is to lay the groundwork for demonstrating the economic viability and environmental benefits of utilizing very high-temperature, geothermal resources to meet the Nation's demand for electricity.

In addition, valuable data on the structure of the Earth's crust, the distribution of elements within the crust, and the association of precious metals and volcanic activity in this area will be obtained.

Copies of this proposal have been submitted to DOE headquarters in Washington and the Senator's office in Reno. The Division of Earth Sciences respectfully requests the Senator to consider this program in addition to the recommendations listed in the written testimony. Thank you.

[The prepared statement of Mr. Flynn follows:]

MUSEUM OF NATURAL HISTORY
ENVIRONMENTAL RESEARCH CENTER
DIVISION OF EARTH SCIENCES
UNIVERSITY OF NEVADA, LAS VEGAS
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April 16, 1984

Honorable Chic Hecht
Chairman, Senate Subcommittee
on Energy and Mineral Resources
Field Hearing
April 17, 1984, Sparks, Nevada

300 Booth St., Suite 2014
Reno, Nevada 89509

Mr. Chairman:

On behalf of the University of Nevada, Las Vegas and the Division of Earth Sciences, I'd like to thank you for the opportunity to appear before the Senate Subcommittee on Energy and Mineral Resources and to present written testimony concerning geothermal energy utilization in Nevada.

Pursuant to the rules of the Committee, I am submitting ten copies of my written testimony to your office. I have arranged the testimony, for your convenience, according to the following format:

1. Description of the Division of Earth Sciences and a listing of major research activities and accomplishments,
2. Principal areas of direct utilization of geothermal resources in Nevada and potential municipal space heating districts,
3. Recommendations submitted to the U.S. Department of Energy, Division of Geothermal Energy for low- to moderate-temperature geothermal research and development in Nevada,
4. The effect of IRS Revenue Ruling 81-304 on geothermal development in Nevada,
5. Present and proposed research for development of high-temperature geothermal resources.

In addition, I have included a bibliography of our research in the field of geothermal energy as well as a copy of our most recent map, GEOTHERMAL RESOURCES OF NEVADA.

Thank you again for this opportunity. I'll look forward to working with you and your staff on developing geothermal resources throughout Nevada.

Very sincerely,

Thomas Flynn
Research Associate/Geologist

TF:sw

Enclosures

1. DIVISION OF EARTH SCIENCES

The Division of Earth Sciences (DES) is affiliated with the Environmental Research Center, University of Nevada, Las Vegas. The group consists of geologists, geochemists, and engineers and began operations in its Reno office in April, 1981. The Division of Earth Sciences is the principal geothermal research group in the State of Nevada. Under the direction of Dennis Trexler, the group has completed statewide assessment programs, and several regional exploration and reservoir confirmation studies. The most recent publication is a 1:500,000 scale full color map entitled "Geothermal Resources of Nevada." The map was prepared in cooperation with the U.S. Geological Survey, the National Oceanic and Atmospheric Administration and was funded by the U.S. Department of Energy, Division of Geothermal Energy. This publication updates a 1979 map and shows location, temperature and other data for more than 900 geothermal springs and wells throughout the state.

DES is supported entirely by federal grants and cooperative agreements with the U.S. Department of Energy, and its primary function is to perform geothermal resource assessment work and to promote direct utilization of geothermal energy. The major contributions of the members of this group include:

DATE	PRINCIPAL ACTIVITY
1979	A map entitled "Geothermal Resources of Nevada and Their Potential for Direct Utilization" was published under the auspices of the U.S. DOE sponsored State-Coupled Geothermal Resource Assessment Program. The map presented data on more than 300 geothermal springs and wells using symbols to represent location, temperatures, pH, flow rate and chemical composition. In addition, 37

DATE	PRINCIPAL ACTIVITY
	regions were evaluated on the basis of their potential for direct utilization. The evaluation was based on both resource and application parameters and ranked both according to established limits. The evaluation was applied statewide and demonstrated the technical feasibility of direct utilization of geothermal energy.
1980-82	In order to further stimulate development of geothermal resources by reducing some of the risk associated with exploration, the U.S. DOE expanded the scope of the State-Coupled Resources Assessment Program to include preliminary resource assessment of areas considered favorable for development. In addition, the program also tested the effectiveness of scientific exploration methods developed for low- and moderate-temperature geothermal resources. Eight areas were investigated including: 1) Carson-Eagle Valley 2) Big Smoky Valley 3) Hawthorne Area 4) Paradise Valley 5) Southern Carson Sink (Fallon Area) 6) Caliente 7) Pumpernickel Valley 8) Carlin Data from geothermal areas throughout the state were also collected in anticipation of updating the geothermal resources map of Nevada. One such area, Moana in Reno, is the largest single area in the state that utilizes geothermal fluids for space heating.

DATE	PRINCIPAL ACTIVITY
	The area specific program consisted of: 1) Literature search and review 2) Geologic reconnaissance 3) Air photo and satellite image survey 4) Fluid geochemistry and temperature survey 5) Soil mercury survey 6) Gravity survey, seismic data acquisition and interpretation 7) Temperature probe survey to a 2-meter depth 8) Temperature gradient well drilling 9) Measurements in existing thermal wells 10) Publication of findings and recommendations The data were made available and gathered immediate attention, particularly in Caliente and Hawthorne. Based on subsequent work in these areas, a viable geothermal reservoir was found to exist within one mile of these municipalities. Furthermore, work performed by the Oregon Institute of Technology, determined that the geothermal resource could economically support a municipal space-heating district. Additional data on these areas is included with the list of recommendations.
1983-84	Following the successful completion of the area-specific assessment program, the Division of Earth Sciences began work on three new projects. 1) Geothermal Reservoir Management Study, Moana Geothermal Area. A detailed geologic and hydrologic research program was completed to determine the geophysical and geochemical characteristics of

the Moana geothermal area. The study incorporated baseline data, that had been previously collected, with a gravity survey, a fluid chemistry sampling program, and a monitor-well program. The final report lists data for more than 140 geothermal wells which are used to supply heat and hot water to a minimum of 160 homes, several large motels and churches. The study recommended maintaining a monitoring program to ensure that planned development could be prudently carried out and that it not "outpace" the resource. Proposed research in Moana is listed with the recommendations.

2) Geochemical Analyses of Recent Volcanic Rocks. This study focused on areas in western Nevada with abundant recent volcanic rocks of basaltic composition. Areas such as this have been ignored in the past. The report concluded that, based on mineral composition and age, areas characterized by recent basalts represented potential geothermal areas that have not been completely investigated.

3) In March, 1984, the Division of Earth Sciences announced the publication of a new, full-color map entitled Geothermal Resources of Nevada. The map was prepared under contract to the U.S. Dept. of Energy in cooperation with the National Oceanic and Atmospheric Administration. Nevada is one of sixteen states that was invited to participate in a Statewide Geothermal Assessment Program. The map was printed at a scale of 1:500,000 (44' x 68") and shows the

DATE	PRINCIPAL ACTIVITY
	locations of more than 900 geothermal springs and wells throughout the state. An accompanying table lists temperatures, well depths, flow rates, and total dissolved solid contents of the geothermal waters. In addition, selected important geothermal areas are briefly described on the map with short paragraphs explaining significant developments and history of the region. The information depicted on this map represents a three-fold increase from a similar publication in 1979 and demonstrates the growing utilization of geothermal energy within the State of Nevada. The quantity and quality of geothermal resources in Nevada are among the highest in the nation. A copy of this map is included with the written testimony.

Interest in developing Nevada's geothermal resources for direct utilization has dramatically increased. The accompanying map describes most of the exploration and commercial activities that have occurred in Nevada since 1979. The following table summarizes the significant direct-use projects currently in use. In addition, six other areas are listed which are adjacent to known, viable geothermal reservoirs. Although use of geothermal energy for space heating is known to save money (i.e., $200,000 annually in Boise, Idaho, for the Capital Mall project), the initial investment, including well drilling, pipelines, and retrofitting may be very costly.

In order to take advantage of the nearby resource and maximize monies invested, the Division of Earth Sciences proposes that the federal government establish a geothermal construction fund for municipalities adjacent to geothermal resources. Monies received as grants could be used, with appropriate state funds to construct the major portion of a geothermal space heating district, owned and operated by the municipality. Then, in order to perpetuate the fund within the state, a portion of monies saved by using geothermal (instead of conventional fossil fuels) could be reinvested in other geothermal projects throughout Nevada.

2. PRINCIPAL AREAS OF DIRECT UTILIZATION OF GEOTHERMAL RESOURCES IN NEVADA

MOANA:	More than 150 homes and several commercial establishments use geothermal for space and water heating applications.
CALIENTE:	A trailer park, a hospital, and several residences use geothermal for space heating.
WABUSKA:	Several aqua-culture and industrial process heating applications have employed geothermal energy.
DUCKWATER:	Catfish are grown in geothermal waters - employs several Native Americans.
PINYON HILLS:	Ten to fifteen homes use geothermal for space heating applications.
BRADY HOT SPRINGS:	An onion dehydration plant uses geothermal fluids in food processing and heating.
ELKO:	A bank, laundry, and hotel use geothermal fluids for space heating and industrial process heating.

POTENTIAL MUNICIPAL SPACE HEATING DISTRICTS

GABBS GOLCONDA HAWTHORNE CALIENTE GERLACH WELLS	All of these areas are adjacent to viable geothermal reservoirs which could be developed using federal funds. Money would be saved and fuel would be conserved.

3. RECOMMENDATIONS FOR RESEARCH AND DEVELOPMENT
STATE OF NEVADA

The following list of recommendations was submitted to the U.S. Department of Energy, Division of Geothermal Energy, in Washington, D.C., March 23, 1984.

These suggestions are based on experience with previously funded U.S. DOE programs, the historical development of geothermal resources in Nevada, and anticipated research and development programs that are required to ensure prudent geothermal resource development.

1) Continue to collect geothermal data statewide and to help coordinate exploration and commercial activities. Data will be provided to state agencies; congressional delegations and subcommittees; the U.S. Department of Energy; IRS; planners; developers; and other interested parties.

2) Develop cooperative agreements with neighboring states to explore for and help develop "state-line" resources. A proposal to investigate geothermal resources associated with recent volcanic activity in the Long Valley, California, Aurora Craters, Nevada, area has been jointly submitted with California, to DOE.

3) Develop cooperative agreements with Nevada's mineral industry to use geothermal fluids for gold heap leaching operations. A proposal describing this activity has been submitted to DOE.

4) Continue to monitor reservoir data in the Moana geothermal area and to delineate areas suitable for fluid reinjection. A proposal describing this program has been submitted to DOE (see attached narrative on Moana).

5) Continue to cooperate with other federal agencies interested in geothermal development. The Division of Earth Sciences has participated in programs with the U.S. Geological Survey, statewide, the U.S. Army in Hawthorne and the U.S. Navy in Fallon, Nevada, and Twentynine Palms, California.

6) Continue resource assessment in established communities using slim-hole drilling surveys. Continue established cooperative agreement with the GEO-HEAT Utilization Center at the Oregon Institute of Technology. Such programs have already produced beneficial results in Caliente and Hawthorne, Nevada.

7) Assist DOE in establishing criteria for direct funding of municipal-operated geothermal space heating districts. Several areas in Nevada (see attached narrative on Hawthorne and Caliente) are economically depressed but are adjacent to viable geothermal resources. Federal money used to develop the major portions of a geothermal space heating district could be reinvested, statewide, by returning a portion of the money saved by using a geothermal heating system.

HAWTHORNE

A large geothermal reservoir, with maximum temperatures ranging from 90 to 95°C at a depth of 500 to 800 feet below the surface, is located approximately 1 mile west of the City of Hawthorne (pop. 5,000) in Mineral County, Nevada. The resource extends north-south along the eastern edge of the Wassuk Range for a minimum of 2 to 3 miles. Water wells located near the city range in temperature from 30 to 40°C, reflecting a general cooling in the west to east direction.

Chemical analyses of the geothermal waters show that they are nearly potable; these fluids contain approximately 800 ppm total dissolved solids (TDS) with a near neutral pH.

There are no surface manifestations of geothermal fluids in Hawthorne. The "discovery" well was drilled by "accident." The El Capitan Lodge had originally intended to drill a water well to irrigate a proposed golf course. This was ruled out as an option when they discovered the well could produce 210°F water, which was considered unsuitable for watering purposes.

A pump test performed on this well produced 532 gallons per minute (gpm) water with a temperature of 210°F. A maximum drawdown of 31 feet was recovered within 4 hours. This report concluded that this single well could support a space heating district that included all public buildings in the City of Hawthorne. This conclusion was based on a preliminary feasibility study, conducted by the Oregon Institute of Technology, that assumed a flow rate of 780 gpm.

A subsequent economic feasibility study, that considered 100% financing at 12% interest, assuming the same heat load, found a substantial negative cumulative cash flow after 20 years. Accordingly, resource utilization was judged uneconomical.

The U.S. Army is now proceeding with plans to develop a geothermal space heating district on the Hawthorne Army Ammunition Base. This system will cost approximately $4.5 million dollars and is based largely on work completed by the Division of Earth Sciences in the Hawthorne area.

We recommend a feasibility study that considers expanding the end user base to include additional residential and commercial users. In addition, some form of federal funding should be available to municipalities that can develop geothermal resources for district space heating.

CALIENTE

Preliminary exploratory work, performed by the Nevada Resource Assessment Team, identified 2 drill sites believed to be favorable for discovery of geothermal resources. Subsequent drilling at one site confirmed the presence of a viable geothermal resource immediately adjacent to the City of Caliente (pop. 1,000). A ten day pump test performed on one well produced 180°F water at 300 gpm with only 5 feet of drawdown. Original water level recovery occurred instantaneously after cessation of pumping. The geothermal fluids are so low in TDS that they are potable; they may be used directly as a hot water source.

Subsequent drilling and pump tests demonstrated that the resource could produce 1100 gpm of 170°F water with 13 feet of drawdown.

An economic feasibility study, performed by the Oregon Institute of Technology (OIT) found that a city-wide geothermal space heating district was both technically and economically feasible. The cost of the installed system was estimated to be $2.5 million dollars. This number includes excessive costs associated with well drilling and pumps. The Division of Earth Sciences has asked OIT to perform a second feasibility study based on the latest resource data. In addition, OIT will be asked to consider additional heat loads and possible commercial or recreational end uses.

Direct federal funds should be made available to complete the major and secondary trunk lines of a piping system. The savings incurred include both dollars and surplus electric power, which could be used for economic development in the depressed area. Caliente can import only a limited amount of electric power. Use of geothermal power could create the surplus required to sustain growth.

MOANA

The Moana area, in southwest Reno, is the site of the largest low- to moderate-temperature geothermal resource in Nevada. A minimum of 150 shallow-depth geothermal wells, representing an estimated $5 to $7 million dollar investment, all privately funded, supply heat and hot water to nearly 200 homes, commercial buildings and churches. The Moana area is one of the largest direct-use geothermal area in the United States; Klamath Falls, Oregon, has approximately 400 wells.

This area has enjoyed enhanced geothermal development because the three most important factors that make or break a geothermal resource are optimized in Moana. These factors were originally identified and described by the Nevada Geothermal Resource Assessment Team on a 1979 map entitled Geothermal Resources of Nevada and Their Potential for Direct Utilization. The three factors, in order of importance, are:

1) Population: a large population is located directly over the reservoir.
2) Depth-to-resource is not large: reduced drilling costs enhance affordability of system.
3) Temperature: the principal use in this area is space heating and the resource temperature (30 to 97°C) is more than adequate for this purpose.

Additional factors favoring geothermal development include the regulatory posture of the State of Nevada, the availability of local expertise, including drillers and plumbers, and the availability of accurate, non-biased resource data supplied by the Division of Earth Sciences and funded by the U.S. Department of Energy.

Historically, geothermal resources have been developed with private funds; little or no attention was given to establishing limits of resource capacity or of monitoring uses. Two large-scale projects currently under construction, and wholly privately funded, include:

1) Warren Estates: plans call for a 60 home geothermal space heating district from a single well,
2) Sierra Geothermal, Inc.: intends to heat as many as 150 homes with geothermal energy.

A recently completed report of the geology and hydrology of the Moana resource delineated the size, depth, and temperature range of the resource. Recommendations included small-scale space heating districts, geothermal fluid reinjection, and continued monitoring of the resource. Present commercial development encompasses the first two suggestions. Continued monitoring and data collection is necessary to ensure prudent resource development and represents an area that the U.S. DOE should support.

Present and prospective developers have already demonstrated the economic viability of the Moana reservoir. The U.S. DOE could assist in this development by continuing to support the reservoir monitoring program.

4. EFFECT OF IRS REVENUE RULING 81-304 ON GEOTHERMAL DEVELOPMENT IN NEVADA

It is a rare occasion when we can point out one Federal regulation that clearly straddles the path of our progress towards energy independence. It is an equally rare occasion when the solution to such an institutional barrier is as simple to accomplish. The Federal regulation in question is the Internal Revenue Service Revenue Ruling 81-304, which prohibits the use of residential geothermal tax credits for fluids with a temperature less than 50°C (122°F). The solution to this obstacle is abolition of this arbitrary ruling which has no basis in scientific fact.

Geothermal resources are widespread throughout the United States, but are concentrated largely in the West. The State of Nevada has more than 900 geothermal springs and wells. In this case, "geothermal" refers to fluids with temperatures of 20°C (68°F) or above. This temperature reflects the standards of the U.S. Geological Survey, which defines a geothermal anomaly as a fluid temperature of 10°C or above mean annual air temperature. In addition to temperature, chemical composition and proximity to geothermal areas (characterized by hot springs, geysers, etc.) should also be considered.

A geothermal reservoir is a complex geologic structure that may exhibit a wide range of temperatures. The geothermal reservoir does not begin nor end on the basis of the arbitrary limit of 122°F now imposed by the IRS. No similar ruling exists for solar or wind power technology.

This ruling (IRS RR 81-304) has already had a rather devastating effect on Nevadans. Mr. J. Crawford of Reno was recently denied a residential energy tax credit bacause a geothermal well that he and a neighbor use to heat their homes (located in the Moana geothermal area) has a reported temperature of 121°F; one degree below the "legal" limit. Another resident of Reno, Mr. D. Warwick, was originally granted a tax credit for his geothermal well, which is near the edge of the geothermal area, but is still 88°F. The IRS now claims that, on the basis of this post facto ruling, Mr. Warwick must return the tax credit to the IRS.

We have recently completed work in the Moana geothermal area in Reno. Based on the IRS Ruling, nearly 20% of the present users would be excluded from claiming geothermal energy tax credits because their geothermal wells are, according to the IRS, not geothermal.

At the present time, there are two bills stalled on the floor of the Senate (S.1237) and House of Representatives (H.R. 2927). These bills are intended to remove bureaucratic hurdles associated with the arbitrary definition of geothermal now enforced by the IRS. The major opponents to these bills cite the growing federal budget deficit and claim that extending the tax credit to include groundwater heat pumps threatens the resolution of the national problem. Frankly, I believe that reducing oil imports by utilizing more domestic energy resources, including geothermal, will reduce the budget deficit. I fail to follow the logic of the opponents of the bills.

Recent work completed by the U.S. Department of Energy and the U.S. Geological Survey indicates that vast areas of the United States are underlain by low- to moderate-temperature geothermal resources. If the present IRS ruling is allowed to stand, much of this resource will remain undeveloped. Successfully locating an economically usable resource is an inherently risky business. Direct utilization of all geothermal resources does represent a step towards decreasing our dependence on imported oil as well as reducing combustion of fossil fuels for home heating. Considering the smog problem in the Truckee Meadows, and elsewhere in the United States, every little bit helps. The IRS ruling adds a burden that is unnecessary, unsound, and unwarranted. I urge you to support legislation aimed at the abolition of IRS 81-304.

5. PRESENT AND PROPOSED RESEARCH

The Division of Earth Sciences and the California Division of Mines and Geology are currently cooperating on the baseline data acquisition phase of a project to investigate reservoir characteristics and geothermal fluid genesis associated with magmatic activity in eastern California and western Nevada. This joint geologic program is being funded by the U.S. Department of Enery and represents a spirit of cooperation between these two states that has not previously been attempted.

Recent warnings, issued by the U.S. Geological Survey in the area around Mammoth Lakes, California, have been based on seismic data in an area of recent volcanism. These seismic data may also be used to identify and delineate magma chambers that are within drilling distance of the surface. Magma represents the ultimate geothermal resource and preliminary studies indicate that it is technically feasible to drill into and recover steam from shallow magma bodies.

The Division of Earth Sciences has recently submitted a proposal to conduct geologic field surveys and moderate-depth exploration drilling (2,000 feet) in the Long Valley, Aurora Craters area. The goal of this research is to locate favorable sites for the drilling, completion, and testing of a very deep drill hole (15,000 to 20,000 feet). The target for this hole will be a shallow magma body, several of which are believed to be located within the study area.

The program has been structured to accomodate recommendations and input from interested government, industry, and academic organizations. The goal of this study is to lay the groundwork for demonstrating the economic viability and environmental benefits of utilizing very high-temperature geothermal resources to meet the Nation's demand for electricity. In addition, valuable data on the structure of the Earth's crust, the distribution of elements within the crust, and the association of precious metals and volcanic activity in this area will be obtained.

WORK PERFORMED UNDER CONTRACT TO THE DEPARTMENT OF ENERGY

Trexler, D.T., 1977, Summary report of availability of geothermal data for potential direct heat application in Nevada: U.S. DOE Report NVO/0671-1, 10 p.

Trexler, D.T., Bell, E.J., and Roquemore, G.R., 1978, Evaluation of lineament analysis as an exploration technique for geothermal energy, central and western Nevada: U.S. DOE Report NVO/0671-2, 78 p.

Trexler, D.T., Flynn, and Koenig, B.A., 1979, Assessment of low- to moderate-temperature geothermal resources of Nevada, Final Report; includes 1:500,000 scale map of the Geothermal Resources of Nevada and their potential for direct utilization: prepared for the U.S. DOE, Division of Geothermal Energy, under Contract ET-78S-08-1556.

Trexler, D.T., Koenig, B.A., Flynn, T., and Bruce, J.L., 1980, Assessment of geothermal resources of Carson-Eagle Valleys and Big Smoky Valley, Nevada: Work performed under U.S. DOE Contract No. DE-AC08-79NV10039.

Trexler, D.T., Flynn, T., Koenig, B.A., and Bruce, J.L., 1980, Assessment of geothermal resources of Caliente, Nevada: Work performed under U.S. DOE Contract No. DE-AC08-79NV10039.

Trexler, D.T., Koenig, B.A., Flynn, T., Bruce, J.L., and Ghusn, G., Jr., 1981, Area specific geothermal assessment, Nevada; Hawthorne area, Paradise Valley, Southern Carson Sink: NTIS No. DOE/NV/10039-3, 203 p.

Koenig, B.A., Flynn, T., and Bruce, L.P., 1981, Pump test of El Capitan geothermal well Hawthorne, Nevada: Prepared for Nevada Dept. of Energy, 400 W. King St., Carson City, Nevada.

Trexler, D.T., Bruce, J.L., Cates, D., and Covington C.H., 1982, Geothermal assessment of the MX deployment area in Nevada: NTIS No. DOE/NV/10187-1.

Trexler, D.T., Flynn, T., Koenig, B.A., Bell, E.J., and Ghusn, G., Jr., 1982, Low- to moderate-temperature geothermal assessment for Nevada: Area Specific Studies Pumpernickel Valley, Carlin and Moana: NTIS No. DOE/NV10220-1.

Trexler, D.T., Flynn, T., Koenig, B.A., and Ghusn, G.E., Jr., 1983, Geothermal Resources of Nevada: National Oceanic and Atmospheric Administration Map Series, 1:500,000 scale; Division of Earth Sciences, University of Nevada, Las Vegas, Prepared under DOE Contract No. DE-AC08-81NV10220.

Fultz, L.A., Bell, E.J., and Trexler, D.T., 1984, Geochemistry, age and strontium isotope composition of late Tertiary and Quaternary basalts and andesites in western Nevada and their relation to geothermal potential: Final Report, U.S. DOE Contract No. AC03-82RA50075 (in press).

Flynn, T., and Ghusn, G.E., Jr., 1984, Geologic and hydrologic research on the Moana geothermal system, Washoe County, Nevada: Final Report, U.S. DOE Contract No. AC03-82RA50075, 148 p.

PAPERS AS A RESULT OF WORK PERFORMED UNDER DOE CONTRACT

Koenig, B.A., Trexler, D.T., and Flynn, T., 1979, Nevada's geothermal resources and their potential for direct utilization: in Geothermal Resources Council TRANSACTIONS, vol. 3, September, 1979, p. 345-347.

Flynn, T., Trexler, D.T., and Koenig, B.A., 1979, Use of thermophilic algae in geothermal exploration programs: in Geothermal Resources Council TRANSACTIONS, vol. 3, September, 1979, p. 213-215.

Koenig, B.A., Trexler, D.T., and Flynn, T., 1980, Fluid chemistry studies of three low- to moderate-temperature geothermal resource areas in Nevada: in Geothermal Resources Council TRANSACTIONS, vol. 4, September, 1980, p. 169-172.

Flynn, T., Koenig, B.A., Trexler, D.T., and Bruce J., 1980, Area specific investigations of three low- to moderate-temperature geothermal resource areas in Nevada: Geothermal Resources Council TRANSACTIONS, v. 4.

Trexler, D.T., Flynn, T., Koenig, B.A., and Bruce J.L., 1981, Nevada resource assessment program - 1980 in Glenwood Springs: TECHNICAL CONF. PROC., vol. 1, Rept. DOE/ID/12079-39, University of Utah Res. Inst.

Flynn, T., Trexler, D.T., and Koenig, B.A., 1982, The Kemp thermal anomaly: A newly discovered geothermal resource in Pumpernickel Valley, Nevada: Geothermal Resources Council, TRANSACTIONS, v. 6.

Ghusn, G.E., Jr., and Flynn, T., 1983, Assessment of the Moana geothermal resource, Reno, Nevada: Paper presented at the 12th Annual Rocky Mountain Groundwater Conference, Boise, Idaho, April, 1983.

Flynn, T., 1983, Implications of groundwater pollution by geothermal utilization: Presentation at the Nevada Water Pollution Control Association 1983 Annual Conference and Operators Short Course, September, 1983.

Trexler, D.T., and Flynn, T., 1983, Geothermal research in Nevada: in Proceedings of the Geothermal Program Review II, sponsored by: U.S. Department of Energy, Report No. CONF-8310177, October, 1983.

Flynn, T., and Ghusn, G., Jr., 1983, Geologic and hydrologic research on the Moana geothermal system, Washoe County, Nevada: Paper in Geothermal Resources Council TRANSACTIONS, vol. 7, October 1983, p. 417-421.

Trexler, D.T., and Flynn, T., 1983, (Trexler) Geothermal heap leaching; (Flynn) Moana assessment: Notes From 36th Geothermal Coordinating Group Meeting, (OGLE Meeting); Sponsored by U.S. Department of Energy, November, 1983.

Fultz, L.A., Bell, E.J., and Trexler, D.T., 1983, Volcanic rock petrochemistry as an exploration technique for geothermal energy: Geothermal Resources Council TRANSACTIONS, v. 7, p. 289-294.

Bell, E.J., Fultz, L.A., and Trexler, D.T., 1984, K-Ar isotopic ages of volcanic rocks in the Reno 1 x 2° AMS sheet, western Nevada: in ISOCHRON WEST (Nevada Bureau of Mines and Geology publication), DOE Contract No. AC03-82RA50075 (in press).

Senator HECHT. Thank you very much. Your comments on the IRS were very appropriate a day after the filing of income tax.

Mr. Sheldon Gordon, Chilton Engineering.

STATEMENT OF SHELDON S. GORDON, VICE PRESIDENT, CHILTON ENGINEERING, CHARTERED

Mr. GORDON. Good afternoon. I'd like to start by noting the difference in the line of testimony that's being received at this point.

We have heard a lot of discussion of power resource development, and we'd like to talk for a few minutes, I think, the other members of the panel included, about direct uses of geothermal energy in this State and the fact that these direct uses of geothermal energy in terms of the energy they displace focus on fossil fuels primarily rather than electric generation.

I am a principal in the firm of Chilton Engineering, chartered, a Nevada engineering consulting firm with office, in Reno, Las Vegas, and Elko. And our firm is active in energy conservation and renewable resource project development work in this State, including geothermal direct-use systems.

As director of Chilton Engineering's Energy System Division, I have acted as project manager on feasibility and design studies resulting in the construction of geothermal direct-use systems for the Elko Heat Co., a utility that's been mentioned in earlier testimony, Walley's Hot Springs Resort in Genoa, and the Elko Sewage Treatment Plant, probably the first geothermally heated sewage treatment plant in the Nation.

Energy Systems Division has also completed feasibility investigations for geothermal direct-use systems at White Sands Missile Range and Hawthorne Army Ammunition Plant for the U.S. Army Corps of Engineers. Our firm has also conducted initial feasibility investigations for geothermal direct-use systems for Mineral County, the Elko County School District and the city of Carlin, Nev. I am a registered professional mechanical engineer licensed in the States of Nevada, California, and New Mexico.

As I said, I'd like to confine my testimony today to the direct use of hydrothermal fluids to displace conventional fuels, primarily natural gas, fuel oil, propane.

As the committee is aware, the State of Nevada is blessed with quite extensive near-surface, geothermal resources which are evidenced by numerous warm and boiling springs, primarily over the northern two-thirds of our State, and current uses of these hot water sources include processed water heating, space conditioning, crop drying, aquaculture, ethanol production, and recreational uses. With the exception of the last item, these applications are significant primarily in that they provide a long-term stabilization of energy costs for commercial ventures and institutions making use of these resources.

I'd like to talk about a geothermal direct-use system that serves a number of customers in Elko, NV. It is serving a commercial laundry, an office building, a 400-unit hotel, the First Interstate Bank branch office building, and the Elko Sewage Treatment Plant. The project uses source water at 177 °F from an artesian well just west of Elko, with a water pressure of about 77 psi, and transmits that energy by 5,000 feet of distribution and 5,000 feet of collection to the downtown.

One interesting characteristic of the project is that the produced fluids meet U.S.P.H.S. drinking water standards, and after the heat has been removed, they are collected for reuse by the city of Elko for irrigation purposes.

In my mind, the project represents an excellent example of the proper relationship between Federal support and private endeavors. The Federal support came to us in the form of grants from the U.S. Department of Energy in the 1977 project opportunity notice for direct-use experiments. That money was used to complete the research development phase of the project, perceived high risk portion of it.

The private endeavor came in the form of investor dollars for construction and operational system.

Most significant impediment to development of direct-use systems—and I will emphasize, this is only in regard to direct-use systems; although, we all have money problems in these projects—is the high risk associated with resource development when compared with the relatively modest rates of return associated with the operating district heating utility. This risk creates an impediment in the public sector as well, where the concern is not earnings but savings of public dollars.

In my opinion, the principal role for the Federal Government may be in the area of alleviating through financial support the high-risk elements of geothermal development, principal resource assessment and production, initial production. This was the stated role at the early demonstration projects that was set forth by U.S. Department of Energy and later abandoned, and in my mind, a valuable and prudent role for government in this instance.

Other than those mentioned by Tom, which was primarily legislative impediments, I see no current technical impediments to direct use for the purpose stated above. Nor are they any Federal impediments to direct-use development under current law and practice.

However, I should comment on one apparent existing bureaucratic impediment within this State that was created by the 1983 Nevada Legislature when they placed responsibility for geothermal development in the department of minerals. In my opinion, this direct use of geothermal energy in Nevada is principally an issue of ground water management and as such should remain directly under the auspices of the State of Nevada, Department of Conservation and Natural Resources, Office of the State Engineer. To provide a dual responsibility with the newly created minerals department, in my opinion, creates an unnecessary and confusing government overlay which will surely delay the development of these systems.

In closing, I'd like to emphasize that the opportunities for community and economic development provided by the long-term stabilization of energy costs should be readily apparent to those of us who have had to contend with the fuel price escalations over the last few years. In Nevada we have a great opportunity to develop a stable energy cost basis on which to build economic growth and enhance community development. And that opportunity is found in the continued development of our geothermal resources throughout the State. Thank you.

[The prepared statement of Mr. Gordon follows:]

E C CHILTON ENGINEERING, Chartered

Statement of Sheldon S. Gordon
Vice President
Chilton Engineering, Chartered
160 Hubbard Way
Reno, Nevada 89502

April 17, 1984

RE: Nevada Field Hearing
of the Senate Subcommittee
on Energy and Mineral Resources

Dear Chairman and Committee Members,

My name is Sheldon Gordon and I am a Principal in Chilton Engineering, Chartered, a Nevada engineering consulting firm with offices in Reno, Las Vegas, and Elko. Our firm is active in energy conservation and renewable resource project development including geothermal direct use systems.

As Director of Chilton Engineering, Chartered's Energy System Division I have acted as project manager on feasibility and design studies resulting in the construction of geothermal direct use systems for the Elko Heat Company (Nevada's first permitted geothermal utility), Walley's Hot Springs Resort in Genoa, and the Elko Sewage Treatment Plant.

The Energy Systems Division has also completed feasibility investigations for geothermal direct use systems at White Sands Missile Range and Hawthorne Army Ammunition Plant for the U.S. Army Corps of Engineers. Our firm has also conducted initial feasibility investigations for geothermal direct use systems for Mineral County, the Elko County School District and the City of Carlin, Nevada. I am a registered Professional Mechanical Engineer licensed in the states of Nevada, California, and New Mexico.

I would like to confine my testimony today to the direct use of hydrothermal fluids to displace conventional fuel sources, principally natural gas, fuel oil, and propane. As the committee is aware, the State of Nevada is blessed with extensive near surface geothermal resources evidenced by the numerous warm and boiling springs distributed primarily over the northern two-thirds of our state. Current uses of Nevada's hot water resources including building space conditioning, process water heating, crop drying, aquaculture, ethanol production, and recreation (i.e., skinny dipping). With the exception of the last item, these applications are significant primarily in that they provide a long term stabilization of energy costs for commercial ventures and institutions making use of these resources.

An operating example of geothermal direct use systems is the Elko Heat Company which currently serves a number of customers in Elko, Nevada.

These include a commercial laundry, an office building, a 400 unit hotel, the First Interstate Bank branch office building, and the Elko Sewage Treatment Plant. The project uses source water at 177°F from an artesian well just west of Elko and transmits energy via 10,000 feet of distribution pipeline. The produced fluids meet U.S.P.H.S. drinking water standards and are reused for irrigation after the heat has been removed by the City of Elko. This project was recently permitted by the Nevada Public Service Commission as an operating utility and represents an excellent example of the proper relationship betweeen federal support and private endeavor. The federal support came in the form of grants from the U.S.D.O.E. to accomplish the resource development phase of the project and the private endeavors came in the form of investor dollars for construction and operation of the system.

The most significant impediment to development of direct use systems in Nevada is the high risk associated with resource development when compared with the relatively modest rates of return available from the operating district heating utility. This risk creates an impediment in the public sector as well, where the concern is not earnings but savings of public dollars. In my opinion the principal role for the federal government may be in the area of alleviating through financial support the high risk elements of geothermal development. This was the stated role of the early demonstration projects supported by the U.S.D.O.E. and is a valuable and prudent role for government.

I would like to state that no current technical impediments exist to the direct use of geothermal fluids for the purposes stated above nor are there any Federal impediments to direct use development under current law and practice. However, I must comment on one apparent existing beauracratic impediment that was created by the 1983 Nevada Legislature when they placed responsibility for geothermal development in the Department of Minerals. In my opinion the direct use of geothermal energy in Nevada is principally an issue of groundwater management and as such should remain directly under the auspices of the State of Nevada, Department of Conservation and Natural Resources, Office of The State Engineer. To provide a dual responsibility with the newly created Minerals Department has created confusion and an unnecessary governmental overlay which will surely delay the development of geothermal direct use systems in the State.

In closing, the opportunities for community and economic development provided by the long term stabilization of energy costs are readily apparent to those of us who have had to contend with the fuel price escalations that have occurred in the last ten years. In Nevada we have a great opportunity to develop a stable energy cost basis on which to build economic growth and enhance community development. That opportunity is found in the continued development of our geothermal resources throughout the state.

Senator HECHT. Thank you very much.

Mr. Larry Garside, energy resources geologist, Nevada Bureau of Mines and Geology, from Reno.

STATEMENT OF LARRY J. GARSIDE, NEVADA BUREAU OF MINES AND GEOLOGY

Mr. GARSIDE. Thank you, Senator Hecht. Perhaps I should explain. The Nevada Bureau of Mines and Geology is a public service and research division of the University of Nevada system. And we are a nonregulatory agency.

I won't attempt to go through all of my statements here. Many of my remarks have already been made.

As you have already seen from some of the previous discussions, Nevada along with a lot of other Western States is endowed with plentiful geothermal resources. More than 300 acres in Nevada alone. Few of these areas and only a few of them have high subsurface temperatures and reservoir rocks suitable for the generation of electricity.

And the best known of these areas, as you have seen from some of the illustrations, are in the northern part of the State. These would be in the area that Sierra Pacific Power in general services.

There have been a number of energy companies over the past 10 to 12 years that have explored for these high temperatures resources, and recently, as you have heard, Sierra Pacific Power has signed agreements with three companies to produce electric power generated from geothermal energy.

However, the exploration for these high-temperature resources was down in 1983. I think this reduction is probably a result of continued low fossil fuel prices and decisions by several major companies to reduce or end their nonpetroleum exploration expenditures.

I believe agreements with utilities for the purchase of geothermally generated electricity would be a more effective incentive than further drilling.

Many of the State's high-temperature resources have probably been discovered. So, future drilling will depend, in large part, on the pace of geothermal field developments. The trend to small 5- to 15-megawatt plants, which you have heard mentioned before, or single wellhead generators, in remote developing fields, I think will probably extend to Nevada in the next 2 to 3 years.

For every one of these high temperature geothermal areas in the State that is capable of electric power generation, there are 50 or more low temperature geothermal areas. These geothermal resources have an enormous potential for a wide variety of nonelectric, so-called nonelectric uses. And of course, these were used in the early days, the 1800's, for a number of spas, and they are certainly used today at Walley's Hot Springs as an example.

However, many of these warm springs are in rather remote unpopulated areas in the State of Nevada. And the utilization of these low temperature geothermal sources has really only begun.

The thermal springs or wells that are in towns or cities or in areas adjacent to the transportation net are being developed first, and as you have heard, geothermal energy can be used for a number of nonelectric uses: Space heating, heating of domestic hot water, process heat in a number of industries, aquaculture, greenhouse heating, and soil heating.

I will mention a few examples in Nevada, some of which you already heard of. The Elko Heat Co., which Shelly Gordon mentioned.

There are pilot projects in a number of areas in the State to grow freshwater prawns in hot spring waters, Wabuska near Yerington on the Duckwater Indian Reservation. Hobo Hot Springs, which is a few miles south of Carson City.

Sixteen thousand catfish per month were produced a few months ago in 90 degree Fahrenheit thermal waters from springs on the Duckwater Indian Reservation. These fish have been sold to fresh fish markets in both Reno and Las Vegas.

Near Fallon, in Stillwater, there are greenhouses which are producing tomatoes. These tomatoes have been sold on local markets there.

As Tom Flynn mentioned in more detail, there are more than 150 homes in southwest Reno that are heated by individual geothermal wells. A lot of these wells also are utilized to heat the domestic hot water for those homes as well. Another savings.

A housing development in that area has plans to eventually deliver geothermal heat from company-owned wells to about 160 homes that would be constructed on individual lots.

You also heard that there is a geothermal vegetable dehydration plant on Interstate 80, 50 miles east of Reno. It's been in operation about 5 years. It is capable of drying 25 to 30 million pounds of raw onions annually. And the energy costs are expected to be 8 to 10 percent less over the long term, compared to plants that utilize conventional energy sources.

Developers of Nevada's geothermal resources must deal with a number of State and Federal agencies. As the geothermal regulations have evolved over the past few years, some of the permitting procedures have been streamlined. I think you have heard some testimony on that previously.

The recent combination of the U.S. Minerals Management Service with the U.S. Bureau of Land Management, I think should eventually prove one more efficient in that regard.

At the State level, new geothermal drilling regulations are being written, and I believe these will help to standardize the present accepted industry practices. There are delays in the State appropriation of waters for geothermal wells, and these can be a problem for some developers at the present time.

There is a great deal of basic geothermal data available on Nevada's resources. Many of the studies that produced this were funded by the U.S. Department of Energy.

And I think you can see from the attendance here and from some of the testimony that there is a complex private-sector group of specialty companies that's grown up because of this geothermal industry, and these companies are available to do everything from geologic studies to engineering design and financing.

Because investment, as you have heard, in any geothermal project from a home-heating system to electric-generating plant is a high-risk proposition, Federal and State tax incentives will certainly encourage the development of alternate resources. And I would like to mention the tax credit expired again in 1985, and I think extension of this act would help reduce our dependence on fossil fuels.

Again, I'd like to, along with Tom, mention the Internal Revenue Service ruling that geothermal wells with temperatures below 50 degrees centigrade do not qualify for the energy tax credit for renewable energy source costs. And I believe, as he does, that this limit is entirely arbitrary, and there are a number of households in southwest Reno that are utilizing these energy sources today.

[The prepared statement of Mr. Garside follows:]

NEVADA GEOTHERMAL ENERGY

by Larry J. Garside
Nevada Bureau of Mines and Geology

Statement prepared for Senate Subcommittee on Energy and Mineral Resources field hearing, 17 Apr 84, on the present status of geothermal development in Nevada.

Many western states, including Nevada, are endowed with plentiful geothermal resources. Nevada has over 300 areas with hot springs and/or thermal wells. Only a few of these areas have the high subsurface temperatures and reservoir rocks suitable for the generation of electricity. The best known of these high-temperature areas are in the northwestern part of the State. Numerous energy companies have explored these areas over the past 10 years, and wells capable of production have been drilled in at least six areas. Sierra Pacific Power Company, the major northern Nevada utility, recently announced that it had signed agreements with three companies to produce electricity generated with geothermal energy. In two to three years, at least a small part of Nevada's electricity could be generated by geothermal energy resources available within the State.

Exploration for high temperature geothermal resources in Nevada was down in 1983; this reduction was probably a result of continued low fossil-fuel prices and decisions by several major companies to reduce or end their non-petroleum exploration expenditures. Agreements with utilities for the purchase of geothermally generated electricity could increase industry interest in 1984, but the actual production of electricity would be a more effective incentive for further drilling. Many of the State's high-temperture resources have probably been discovered; future drilling will depend, in part, on the pace of geothermal field development. The trend to small (10-15 megawatt) plants or wellhead generators in remote, developing fields will probably extend to Nevada in the next two to three years.

For every high-temperature geothermal area in Nevada capable of electric power generation there are 50 or more lower temperature geothermal areas. These geothermal resources have enormous potential for a wide variety of non-electric uses. In the 1800's and early 1900's many hot springs were developed as spas. Although most of these no longer exist, a number of the State's thermal springs, such as Walley's near Genoa, emphasize the hot-spring pools as an important part of the resort.

Many of Nevada's warm springs are located in remote, unpopulated areas; the utilization of these low-temperature geothermal sources has only begun. Thermal springs or wells in towns or cities or in areas adjacent to the transportation net are being developed first. Geothermal energy can be utilized in a great variety of ways--for space heating and the heating of domestic hot water, for process heat in certain industries, and for aquaculture, greenhouse heating and soil warming, to mention a few. Several examples of Nevada geothermal use illustrate the potential for various uses: in Elko, the Elko Heat Company, using geothermal resources, supplies hot water for space heating and other process heat to a hotel/casino, a laundry, and a bank, and it has plans to extend its service to several other customers. The Nevada Public Service Commission recently approved the company as a public utility.

Pilot projects to grow giant freshwater prawns in Nevada hot-spring waters are underway at Wabuska Hot Springs near Yerington, on the Duckwater Indian Reservation 60 miles southwest of Ely, and at Hobo Hot Springs 8 miles south of Carson City. The prawns do well in water temperatures of $77\text{-}86^{\circ}$F.

As many as 16,000 catfish per month were raised in 90°F thermal waters from springs on the Duckwater Indian Reservation in eastern Nevada. The fish have been sold on the fresh fish market in both Reno and Las Vegas.

Geothermally heated greenhouses at Stillwater, near Fallon, produce tomatoes that have been sold in local markets, and the city of Caliente has a geothermal resource available at shallow depth which could be used for a district heating system.

More than 150 homes in southwest Reno are heated by individual geothermal wells; many homes also utilize geothermal energy to provide domestic hot water. In addition, two motels use geothermal waters to heat their rooms. A housing development in that area plans to eventually deliver geothermal heat (from company-owned wells) to about 160 homes that are being constructed on individual lots.

A geothermal vegetable dehydration plant near Interstate 80, 50 miles east of Reno, was constructed 5 years ago. It can dry 25-30 million pounds of raw onions annually. The facility is expected to have costs 8%-10% less over the long term, compared to plants that utilize conventional energy sources.

Developers of Nevada's geothermal resources must deal with numerous State and Federal agencies. As geothermal regulations have evolved over the past few years, some of the permitting procedures have been streamlined. For example, the recent combination of the U.S. Minerals Management Service with the U.S. Bureau of Land Management should eventually prove more efficient. At the State level, new geothermal drilling regulations are presently being written by the Nevada Department of Minerals. Hopefully, these regulations will standardize the present accepted industry practices. Delays in the State appropriation of waters for geothermal wells are, at present, a major problem for both small and large geothermal developers.

A great deal of basic data is available on Nevada's geothermal resources; many of the studies that produced this information were funded by the U.S. Department of Energy and various State agencies. These studies and financial support gave the geothermal industry an early boost. Today, a complex private-sector group of specality companies is available to do everything from geologic studies to engineering design and financing. However, because investment in any geothermal project, from a home-heating system to a electric generating plant, is a relatively high risk proposition, Federal and State tax incentives will certainly encourage the development of alternate energy resources. The Business Energy Investment Tax Credit expires in 1985; extension of this act would help reduce the U.S. dependence on fossil fuels.

Another area of concern for many individual household geothermal users is the Internal Revenue Service ruling that geothermal wells with temperatures below 50°C (122°F) do not qualify for the energy tax credit for renewable energy source costs. This 50°C limit is arbitrary; several households in southwest Reno are now heated with geothermal waters which are only slightly cooler than 50°C.

Senator **HECHT**. Thank you very much.

Mr. Curtis Framel, manager, energy services, State Department of Community Services, Carson City.

STATEMENT OF CURTIS K. FRAMEL, MANAGER, STATE ENERGY EXTENSION SERVICE, NEVADA STATE OFFICE OF COMMUNITY SERVICES

Mr. **FRAMEL**. Thank you, Senator.

My primary job responsibility as manager of the State's energy extension service is to encourage energy conservation and to promote the use and development of alternative energy resources in the State of Nevada.

The legislature transferred State energy programs to the office of community services as of last July. Under Nevada revised statutes 523.131, section 6, the office of community services, in conjunction with the Desert Research Institute, reviews policies and makes recommendations relating to the development of our State's geothermal resources.

We view geothermal as a natural resource that belongs to Nevadans. To emphasize the need for developing this resource, we need only to understand that in Nevada we import over 95 percent of the fuels we use, as mentioned by the Governor. This means a direct export of capital, illustrated as a dollar hole in the pocket of our economy here.

If these geothermal resources are further developed, and I think we both understand and we can see what is occurring here that they will and are, we would be investing dollars that once went out of our State back into Nevada, giving an additional boost to our economy.

The office of community services believes that geothermal electrical generation has not been fully developed due to past decisions by utility companies to construct coal-fired generation facilities. At the time these decisions were made, perhaps there was not sufficient direction from Government to encourage Nevada utilities to utilize geothermal.

Therefore, the technology did not seem cost effective at the time. The real paradox lies in the fact that plans are now underway to harness the geothermal resources of centraland northern Nevada to feed power into California, as was mentioned earlier. Nevada will become an exporter of geothermal energy yet will remain an importer of expensive fossil fuels.

The Nevada Office of Community Services encourages development of geothermal energy from a nonregulatory standpoint. To do so, we encourage and work directly with citizens, industry, businesses, and private institutions. Our office has available technical data, reports, and the State geothermal resource development plans completed by the Nevada Department of Energy under a U.S. DOE Federal grant.

The area geothermal development plans are extensive summaries of each county's geothermal resources and the potential impact of the development of these resources in each county. This information is available to the public in our library at 1100 East William Street in Carson City.

Our office also manages the State's institutional conservation program which provides Federal funds to schools and hospitals for energy conservation. Recently the Elko School District and Elko General Hospital were awarded nearly $300,000 to assist their geothermal space-heating projects. The school district has an additional application in our office at this time for funds to expand their geothermal project. We are also working with the city of Caliente to possibly assist with their geothermal development project.

In summary, the Nevada Office of Community Services promotes the development of geothermal as an energy source that can provide a direct benefit to citizens of Nevada. We supply both general and technical data on alternative energy resources to the public, work with State and Federal agencies, and will continue to participate in the development of policy to enhance the use of geothermal energy in Nevada.

And in conclusding, I'd just like to commend your efforts here. I think for the first time we see the left hand and the right hand and what they're up to here as far as geothermal activity in this State, and I look forward to seeing the progress from this committee. Thank you very much.

Senator HECHT. Thank you very much. And I was going to mention later, but since you addressed it, after everything is written up about these hearings, we will give you a complete text on everything that went on.

Plus we will put the State projects and what has been recommended by the different witnesses at the State level to enhance its development so that we will have all this information ready for you before the next session of Nevada Legislature.

Mr. Garside, please elaborate on your statement regarding delays in the State appropriation of water for geothermal wells.

Mr. GARSIDE. As I understand it from developers, as you may know, the geothermal wells are permitted as they would be if they were irrigation wells, and some of these permits take up to a year to process.

Senator HECHT. What is the nature of the problems these delays cause geothermal developers?

Mr. GARSIDE. I think that unless you can—if you have a project that you might want to drill, for example, drill several wells, but you are not sure where you want to drill those wells, you would have to permit them all, even if you only planned to drill one, and that one might lead you to drill in another area, and you would not be permitted for that area.

Also it can effect, at least a small developer, in terms of obtaining financing when there is such a long lead time between the actual drilling of a well and the permitting.

Senator HECHT. Thank you. The Deficit Reduction Act of 1984 was passed in the Senate last week. Amongst its provisions it proposes to extend the residential and business geothermal tax credits to 1988. It also proposes to lower the minimum well temperature requirement to 40° Celsius. The corresponding House bill does not contain any of these provisions, and they will be negotiated in conference committee.

It appears that the 40° rule is still objectional to some developers. How widespread is this objection?

Mr. FLYNN. Senator, I will try that.

Senator HECHT. Mr. Flynn.

Mr. FLYNN. Forty degrees centigrade still represents a viable geothermal resource as far as space heating and water heating. My frank opinion is if the IRS is going to consider granting a residential tax credit for something which is geothermal, they should allow the definition from a higher authority, principally the U.S. Geological Survey, Department of Energy, Division of Earth Sciences.

Senator HECHT. How extensive is the problem of 40°?

Mr. FLYNN. Forty degrees would probably represent 10, 15 percent of the people in the Moana area. Boise and Klamath Falls are two other areas that have large space heating districts, and it would probably impact them also.

Senator HECHT. Short of totally eliminating a minimum temperature limit, what would be an acceptable definition if 40° is not suitable?

Mr. GORDON. Could I comment on something you asked earlier?

Senator HECHT. Of course.

Mr. GORDON. A comment maybe on the basis for the 40° exclusion. I think there was some perception by the Department of Energy that this was a difference between the direct use of geothermal energy, using hot source to heat a building directly, and use of a second instrument, that is, heat pump to extract energy.

The reason for that was in accordance with the National Energy Policy Act goal of reducing dependence on foreign oil. And by its interdependence with use of electricity, in case of the use of a heat pump, it didn't quite meet that goal.

What I think Tom is saying, that the exclusion was somewhat arbitrary in the sense that we do have direct-use systems operating below that point independent of heat pumps. But I think there may be a legitimate basis for exclusion in accordance with the policy goal for not considering heat pump systems. That is just a personal opinion.

Senator HECHT. Do you want to answer that question concerning the total elimination a mimimum temperature limit, what would be an acceptable definition if 40° is not suitable?

Mr. FLYNN. The definition of a geothermal resource is proposed by Waring, I believe, in 1919 or something, one of the old U.S. Geological Surveys, was 10 °C above mean annual temperature. That temperature is going to vary. Throughout the State of Nevada we have temperature variations in Las Vegas on the one hand of a magnitude of 20 °C or 30 °C. That is going to vary.

So, a geothermal resource in Las Vegas may, a geothermal resource in Denio may not be a geothermal resource in Las Vegas.

Ten degrees centigrade above mean annual air temperature is also arbitrary. But I think it is a little bit more fair than what the IRS has proposed and what Congress is working on right now.

Senator HECHT. What would that represent in this area?

Mr. FLYNN. What would that represent in this area?

Senator HECHT. In Reno.

Mr. FLYNN. The mean annual air temperature here is 12 °C, I believe. So, we are looking at 22 °C.

Senator HECHT. Thank you.

Mr. Framel, Mr. Reyburn earlier testified that the State legislature established the department of minerals to provide the industry with a strong voice in State government to regulate and promote the development of Nevada's mineral and geothermal resources.

Do you see the activities of your office as complementing or opposing the efforts of the department of minerals?

Mr. FRAMEL. I believe we can complement each other. We see minerals more from a regulatory standpoint. We see ourselves more educational and encouraging residents. I see both of us together working jointly on this. So, complementary.

Senator HECHT. In the interest of fairness, although they have not been officially on the agenda for today, there are three people who have asked to speak. The next panel will be panel 7. Mr. Kenneth Nemzer, Mr. J. W. Herman, and Mr. Bob Warren.

Mr. Kenneth Nemzer, California Energy Co., Santa Rosa, Calif.

STATEMENT OF KENNETH PRESS NEMZER, CALIFORNIA ENERGY CO., INC.

Mr. NEMZER. Yes, thank you. I am Kenneth Nemzer.

I will be very brief. I want to address a subject that hasn't been addressed here, and in fact, has avoided the view of most people. I will try to explain why.

It has to do with the tax bill now pending, the bill that will immediately go to conference committee. I am going to address the extension of the energy tax credit, even though we think that is very important. I am going to address a little notice provision that could have an even greater effect on geothermal and other alternative energies than the energy tax credit extension. It is a provision that is named or rather misnamed the tax exempt entity leasing provision.

Now, the danger of this provision is that powerplants built by developers of geothermal energy and other alternative energy sources could lose their normal tax benefits, not just energy tax benefits but accelerated depreciation and perhaps ordinary investment tax credits.

My intent is to summarize the problem briefly and to avoid the technicalities of the tax bill.

The problem is committee action, and aggressive treasury position, has created an unintended potential effect in a provision that otherwise is not bad, with the effect of denying ordinary tax benefits to qualified facilities, qualifying facilities under PURPA.

The origin of the provision is the Pickle bill, which was meant specifically to cure some abuses having to do with leasing of equipment to tax exempt entities.

The original mechanism of the Pickle bill was as follows. It was to reconstrue certain service contracts as leases. Contracts such as power sale contracts, when the recipient of the power is a tax exempt entity. The abuse in those cases is that the tax-paying entity does not take the risks that they should to get the benefits.

The distortion, the distortion of this principle in some potential versions of the tax bill is the expansion by the Senate Finance Committee to include contracts not involving tax exempt entities.

Legislative history provided by the committee gives support to an aggressive treasury position that the entities to be included are ordinary powerplants built to fulfill the PURPA provisions. That's why I say it is a misnomer.

It now no longer is as the name implies, a provision for tax exempt entity leasing, but for entity leasing—but for a leasing of all kinds of entities. For that reason it slipped by the notice of most people.

Now, the effects are unintended. I have spoken with Congressman J. Pickle, who originated the bill, spoke with him briefly, and he acknowledged that this was not his intention. It was not his intention to interfere with PURPA mandated facilities.

But he also said that he, as the others on the conference committee, have not had the time to foucs on this and to really examine it, which means he and others on the conference committee, Senator Dole, and others, will need some help in focusing on it.

The status of the act. The Senate version has been expanded in this way to include service contracts where the service recipient is a taxable entity, such as an investor-owned utility.

Fortunately, there is a saving amendment, one of Senator Wallop's amendments, that exempts alternative energy projects from the most onerous parts of this.

Now, the status in the House is that it has not, in the House bill it has not expanded yet the provision to service recipients that are taxpayers. But the House Ways and Means staff has made it clear that they are going to accept it and that the expansion to entities that do service recipients that pay back is certain.

The question is whether along with that expansion the Wallop amendment will go along to save the alternative energy projects, not abusive projects but save the ordinary qualifying facility.

Now, the mechanism of the committee change—I will try to be very brief, not get into the technicalities of it—but there are several tests used to reconstrue service contracts as leases. The two most important for these purposes are, No. 1, that there be a single customer for the services.

Now, of course, all qualifying facilities sell to a single utility.

No. 2, that there be a measure of control by the recipient. A measure of control in this case by the utility.

Now, on its face that would seem not to apply. But there is legislative history that shows some intent to have control represented by simply a long-term lease—excuse me—a long-term contract to take the power. Of course, qualifying facilities normally in order to get financing have to have long-term power sale contracts.

There are other tests. The other tests are not onerous because they have to do primarily with the risks taken by the taxpayer, which is the proper purpose of the Pickle bill.

Now, the Wallop amendment very simply exempts alternative energy projects from those two most impressive provisions. So that nonabusive qualifying facilities then would not be reconstrued as leases, and they would not lose their accelerated depreciation and risk losing investment tax credits.

So, the cure is a relatively simple one, if it can be done. As a caveat, if this passes in its worse form we will certainly take the position that aggressive IRS position is wrong and that our qualifying facilities nonetheless should get their tax benefits.

But since the IRS or its representatives have taken a contrary position, that we will lose our benefits, that our friends, the bankers, our financing sources are sure to be chilled.

Senator **Hecht**. Excuse me. Can you summarize, because we are on a tight time schedule.

Mr. **Nemzer**. I am down to my closing remark.

Senator **Hecht**. Fine.

Mr. **Nemzer**. Which is simply that the solution is that Senator Dole and the other conferees, Senator Packwood, Senator Danforth, Senator Matsunaga, and so forth, should be admonished that their version, the Senate version, is very important to pass, not only in respect to energy tax credits but even more so in respect to the leasing provision in what is misnamed the tax-exempt-entity leasing. The Senate version should prevail.

[The prepared statement of Mr. Nemzer follows:]

STATEMENT OF
KENNETH PRESS NEMZER
CALIFORNIA ENERGY COMPANY, INC.

Geothermal Power Contracts:
Potential Impact of the Deficit Reduction Act of 1984
"Tax Exempt Entity Leasing."

California Energy Company, Inc.
Kenneth Press Nemzer
Testimony Before the Senate Subcommittee on Energy and Mineral Resources
April 17, 1984

1. Subject - The pending tax bill contains a little-noticed problem for alternative energy. It is in the section designated "tax exempt entity leasing." The title of the provision, which originated as the "Pickle Bill," is misleading.

2. Intent - This brief will describe relevant parts of the pending tax bill. It will strongly recommend that the Senate version be enacted.

3. Potential Effect - Power plants using geothermal and other alternative energy sources risk loss of significant tax benefits, including tax credits and accelerated depreciation. This would put small power projects at a crucial disadvantage in competing for investment dollars.

4. Problem - Committee action and an aggressive Treasury position have broadened and distorted the "tax-exempt entity leasing" provisions. In the Senate version, they cover also service contracts with taxpaying service recipients, including power sale contracts to utilities: the contracts made pursuant to the Public Utilities Regulatory Policies Act (PURPA).

5. Result to Avoid - If enacted in its most onerous form, the provisions could terminate projects with alternative energy sources and reverse a healthy decentralization of power plants.

6. Origin - The "Pickle Bill" predecessor to the leasing provisions were intended to cure a specific abuse to modify tax benefits for taxpayers avoiding investor risks. The sebsequent expansion was not anticipated, we are told, by the sponsors.

7. Mechanism - The subject provision allows the IRS to construe certain service contracts as leases. Thus, a power plant would be deemed leased to the utility which takes its power. If the power recipient is investor owned, it would have 15-year depreciation and no energy tax credits. If the power recipient is tax exempt, the depreciation can be 30 or 40 years and neither energy tax credits nor investment tax credits would be available. The bill describes 6 tests for the IRS to apply. One or two of those tests, according to the IRS position, can doom a power producer to lessor status and loss of tax benefits.

8. Tests - The most burdensome tests are (1) a single service recipient (power customer) and (2) a significant economic interest in the property by the service recipient. The economic interest test may be deemed satisfied by simply a long-term contract; that is the announced IRS position, with some support in legislative history. Other tests that can be unfair are (3) physical possession of the property (4) and service cost not substantially above rental value.

9. Wallop Amendment - An amendment to the Senate version (only) exempts alternative energy projects from the four tests above set forth. It establishes tests closer to the true purpose of the law: to assure that tax benefits follow investment risks.

10. House Staff Position - Although the house version addresses only projects with tax exempt service recipients, the Ways and Means staff believes the conferees will expand the scope to include taxpaying recipients, as in the Senate version. It is much less clear that the conference committee will adopt the Wallop amendment.

11. Peril of Uncertainty - If the provisions are enacted without the Wallop Amendment, the geothermal energy industry will nonetheless argue against its application to its projects. But we expect a struggle from the IRS. That struggle alone will have a severe, chilling affect upon financing for these projects, which compete for dollars with unaffected industries.

12. Conclusion - The Senate version of the bill, including the "Wallop Amendment," is much to be preferred over the House version or a combination. The cost will be small and temporary. The benefits include clean, decentralized, domestic energy sources with income to produce substantial tax revenues.

Kenneth Press Nemzer
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KN:GFD:4/30/84:615d3

Senator HECHT. Thank you very much.

Mr. J. W. Herman, engineer and consultant, American Thermal Resources.

STATEMENT OF J. W. HERMAN, ENGINEER AND CONSULTANT, AMERICAN THERMAL RESOURCES AND TURBINE INTERNATIONAL

Mr. HERMAN. Senator Hecht, committee, I am really impressed with the presentation and documentation I heard today at this very important testimony given on the geothermal field.

I am associated with American Thermal Resources and Turbine International. My prime purpose here, gentlemen, is only one.

We have invented the world's first new designed turbine, specially designed for the geothermal field. Our patent was just granted to us. We have patent rights. We will start manufacturing this turbine for geothermal fields in Bakersfield beginning next month.

I am so impressed with the documentation and with the presentation of the men and our modular construction will be so simple that the previous turbines that we are using now, and I am a turbine engineer, will be obsolete because our turbine could be adaptable to almost any kind of a condition in the field. Any temperature.

So, to me, this is a momentous occasion, tying in with the geothermal. Thank you, gentlemen, for hearing my appeal, and I am proud to be here.

Senator HECHT. Even though under Federal law we are not allowed to allow advertising, you——

Mr. HERMAN. I had to slip it in, your Honor. I had to slip it in.

Senator HECHT. Mr. Bob Warren, executive director, Nevada Mining Association.

STATEMENT OF BOB WARREN, EXECUTIVE DIRECTOR, NEVADA MINING ASSOCIATION

Mr. WARREN. Thank you, Senator, for the courtesy of a quick off-the-cuff statement.

My purpose in appearing here today is to acquaint you with the enthusiasm and support that the mining industry has for the geothermal industry. Our Governor, as you know, earlier pointed out that the Department of Minerals was created which gave you a home for the geothermal industry.

The Department of Minerals was created by a bill which was drafted by the department—by the Nevada Mining Association, with the help of the other mining groups, and with the help of the legislature, of course, our friends in the legislature and the support of the Governor.

And we were very careful to include geothermal in that department because the Governor and the legislative leadership felt that the geothermal industry should have a home. It should have an area that should not only regulate the industry but should promote, help, and encourage the industry.

So, it now has a voice in the State of Nevada, a departmental level voice. The geothermal heat resource energy will not be treated just as water but will be recognized indeed as an energy source.

So, I wanted to acquaint you with that, Senator, and some of those folks who testified here today, all of them almost, except in one we invite him too, are members of the Nevada Mining Association, the Nevada operators. We have formed a geothermal committee, and we will be knocking on your door as a committee when necessary or as individuals, and representing the geothermal industry in the legislature.

So, I wanted to let you know that there is great enthusiasm within the mining industry for the geothermal industry, and we think it's properly seated in the Department of Minerals where it will gain a strong voice within State government. Thank you.

Senator HECHT. Thank you very much, Bob. Maybe we should stick to geothermal and forget wilderness. Right, Bob?

Mr. WARREN. Later.

Senator HECHT. I would like to make a couple of observations before we close this hearing. I have been going to hearings in Washington, D.C., now for about a year and a half, since I have been a U.S. Senator, and this is the first hearing that we have had a full house at the close of the hearing, which demonstrates that all of you are very, very concerned, and all of you want to participate and feel that we are heading in the right direction.

I want to thank all of you for coming here, many of you from long distances. I know your time is very, very valuable.

And before closing, I'd also like to make a few initial observations about the testimony we have received today.

First, I am convinced that Nevada's geothermal energy will at some point in the future make a very significant contribution to our State's energy and economic base.

Second, we need to work a few bugs out of the Federal Geothermal Steam Act. As a member of the Senate Energy and Natural Resources Committee, I will continue to push for the enactment of this legislation.

Third, we have heard a great deal about the importance of Federal tax credits. As I have mentioned, it appears that Congress will soon be taking final action on a bill to extend the 15-percent tax credits, lower the well temperature requirement to 40 °C.

I will be sure to continue in my strong support for these Federal tax credits.

Finally, I want to thank everyone for their attendance here today. There are extra copies of today's testimony that are now available from Betty Nevitt on my right, and don't forget to put your name on our list if you would like to receive a copy of the printed record of today's proceedings.

Also I'd be very, very remiss if I did not again thank the staff from Washington, D.C., the Energy Committee, who have traveled out here and did the work in preparation for these hearings, John Laszio, who is on loan to us from private industry, who has worked hard helping to put this hearing together, and who will make a complete comprehensive report on it, and last, Dan Freihoffer, who has been my legislative staff aide on the Energy Committee and has helped me so much.

So, without any further adieu, the subcommittee stands adjourned.

[Whereupon, at 1:27 p.m., the hearing was adjourned.]

APPENDIX

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

STATEMENT IN
BEHALF OF
MAGMA POWER COMPANY

My name is Joseph W. Aidlin. I am Vice President, Secretary and General Counsel of Magma Power Company. I am pleased to present this statement in behalf of Magma Power Company to the field hearing of the Senate Energy and Natural Resources Committee before Senator Chic Hecht of Nevada, held April 17, 1984, in Sparks, Nevada.

It is generally known in the geothermal industry that Magma Power Company was the pioneer in developing geothermal energy in the United States. Magma Power Company was the pioneer not only in defining the resource and establishing its presence and value, but developing the technology for the use of the various forms in which the resource is found for the generation of electric power. We built, using our own funds and without any assistance, public or private, an 11 megawatt capacity binary cycle electric generating plant, using 360°F brine in the East Mesa area of Imperial Valley, California, which plant since October 1982 has operated continuously for over 98% of the time. Magma Power Company has also been in the forefront of developing the technology for the use of highly mineralized brines in the Imperial

Valley, California, also using its own funds. In this latter development, we had valuable assistance from The Department of Energy and from New Albion Resources Company, a wholly owned subsidiary of San Diego Gas & Electric Company, which holds certain leasehold interests in the area together with Magma.

Despite the great potential and practical value of geothermal resources, their commercial use has been inordinately slow. Part of this has been caused by the initial lack of interest on the part of utilities, public and private, in a resource that involved the use of small capacity generating facilities. Part of it was caused by the love affair between utilities and nuclear power. But the greatest drawback has been the inability to compete with high interest rates and high return for capital investment in the light of the long lead time required by the exploration and the development of the resource and reducing the utilization or sale of that resource to commercial return.

An effort was made in the Public Utility Regulatory Policy Act to encourage utility support of geothermal energy, and the Act has been successful in that purpose. However, questions still exist as to the basis upon which utility avoided cost should be computed.

The additional energy investment tax credit has made it possible to begin to interest capital sources, but the industry now faces the uncertainty of a December 31, 1985, expiration date for that tax credit. Without it the competition for essential capital will place geothermal energy in a subordinate position. It is essential to the growth of the industry that the energy investment tax credit be extended. I understand that the Treasury Department policy division has evidenced objection to such extension. This is shortsighted and contrary to public interest. With the energy tax credit there is now a good likelihood for substantial development of geothermal resources and construction of geothermal generating plants. Without it the likelihood of such a development will be dimmed. It is difficult to understand why the Treasury Department cannot see the value of encouraging this industry which is essential from an energy sufficiency standpoint as well as useful to a growing economy.

Based upon the data at hand, it appears that the States of California and Nevada are at the present time hostages to imported electric power sources. They are bringing their power in from the Pacific Northwest states and from Canada but that is a very unhealthy situation in terms of any permanent dependable power. When the time comes, and that could be quite soon, that local electric power sources are needed, it will take additional time to develop such sources.

Much has been said about the amount of money that has been spent by the federal government through The Department of Energy and other agencies with respect to development of geothermal energy. It has been our experience that a good deal of the money spent has been related to technology for the future and not enough to developing the resource and facilities for the present. Less loans and grants but an extension of the Energy Investment Tax Credit and the removal of other impediments would be much more valuable to the development of the industry. If that is not done, we will find that the United States, although a pioneer, will be outstripped by such developing nations as Mexico and the Philippines. That is hardly a result to be wished for.

Respectfully submitted

Joseph W. Aidlin

JOSEPH W. AIDLIN

Written Testimony Submitted
by
Republic Geothermal, Inc.
to the
Senate Energy and Natural Resources Committee
Subcommittee on Energy and Mineral Resources

April 17, 1984

Sparks, Nevada

I. Introduction

This testimony is submitted on behalf of Republic Geothermal, Inc. (RGI). RGI, headquartered in Santa Fe Springs, California, is the nation's largest independent, fully integrated geothermal resource development company engaged in land acquisition, geothermal exploration, drilling, steam and power production and research activities. RGI has been involved in these endeavors since 1973.

The company's most significant undertakings include participation in a $136 million geothermal development and utilization project, which is located in the Imperial Valley of southern California, and will initially produce 25 megawatts of electricity and will eventually produce 49 megawatts of power. This major undertaking, known as the Niland Project, is the recipient of a $99 million federal loan guarantee granted pursuant to Title II of the Geothermal Energy Research Development and Demonstration Act of 1974.

Republic also holds significant geothermal lease acreage with good development potential in southern and northern California, including the Geysers-Calistoga area, and in Nevada in Dixie Valley.

Over the years, RGI has had the opportunity to analyze and comment upon a variety of legislative proposals that would revise the present federal geothermal leasing program by amending the Geothermal Steam Act of 1970. On a prior occasion, Republic had an opportunity to submit testimony in support of S. 883, and as a company directly involved in geothermal resources development, we would strongly urge legislative efforts to expedite the leasing of federal lands for geothermal energy development.

This nation's federal lands hold more than 50 percent of this nation's geothermal reserves and, as this Committee knows, the U.S. Geological Survey has estimated that more than 20,000 megawatts of potential power may be available to be tapped from these domestic energy resources. The continued unrest in the Persian Gulf and this nation's over-dependence on foreign energy supplies demand that we retain and expand our efforts to fully develop this potential energy supply. This legislation is extremely important in this regard.

Two issues addressed in S. 883 urgently need the attention of this Congress: the extension of the primary lease term and the increase of the per state acreage limitation. RGI's testimony will concentrate on these two matters.

II. Extension of the Primary Lease Term

One of the most important aspects of the effort to encourage the production of geothermal energy by improving federal geothermal leasing programs concerns the authorization for the Secretary of the Interior to extend leases beyond the primary term. Under existing law, the primary lease term is 10 years; if geothermal resources are "produced or utilized in commercial quantities" within this 10 year period, the lease term can be extended for an additional 40 years. Section 7 of S. 883 would continue the current 10 year duration of the primary lease term, but would also provide that if geothermal resources are produced or utilized in commercial quantities within these ten years, the lease would then continue for so long as production or use occurs without a 40 year time limitation. Further, under both existing law and section 7(c) of S. 883, production or utilization of geothermal resources in commercial quantities also includes, by definition, the completion of one or more producing or producible wells and a bona fide sale for delivery to a facility or facilities installed or to be installed by a date certain. Section 7(c) of S. 883 would broaden this definition of production or utilization to include, in situations in which the resource is to be utilized directly by the lessee, "proof of commitment to construct such utilization facilities."

Importantly, the legislation includes one final provision which is designed to address and resolve the problems being encountered by geothermal developers in attempting to demonstrate economic utilization of a geothermal lease within the primary lease term. Specifically, the provisions of section 7(c), as currently drafted, would authorize the Secretary, on petition of the lessee, to grant extensions totalling not more than fifteen years beyond the initial expiration date of the primary lease. Under the terms of the legislation, such extensions could be granted only if the lessee has made a substantial investment in the development of the lease and the efforts of the lessee to construct facilities to use geothermal energy to produce usable energy have been hampered by "administrative delays beyond the control of the lessee or due to the demonstrated marginal economics of such a facility."

RGI supports the enactment of these authorities which will provide administrative flexibility in the geothermal leasing program to allow for extensions of the primary lease term. However, the structure of the provisions allowing for extension of the primary lease term is deficient in one very significant respect.

It appears that when sections 7(a) and 7(c) of S. 883 are read together, an extension of the primary lease term will not be available unless a lessee not intending to use the geothermal production itself has entered into a bona fide delivery contract. However, it must be recognized that, just like facility construction, the ability of the lessee to execute such a contract could be impeded by marginal economics and administrative delay. Therefore, RGI strongly recommends that the same criteria that are set forth in S. 883 as applicable to delays in facility construction be applied equally to permit an extension in the primary lease term in the event of delays in the execution of bona fide contracts. Draft language to modify the existing provisions of section 7 in this respect is attached to this testimony for the consideration of the Committee.

An example from RGI's own efforts at development suggests the urgency of the matter. In 1974, RGI became the leaseholder of several thousand acres of federal geothermal resource lands in the Imperial Valley of California. Since the date when the company was originally granted those leases, RGI has expended more than $20 million in development of the leases. These expenditures have been used primarily to demonstrate the commercial capacity of the resource by the drilling of ten production and injection wells.

Since demonstrating the existence of a commercial resource, RGI has also expended significant funds in attempting to sell the geothermal resource to four different utilities. Events over the last few years have made it clear that very few electric utilities, especially those serving the California market, would be willing to contract for the purchase of a geothermal resource and then to construct a geothermal power plant to use those resources. In other words, we will be unable to sell the geothermal resource itself to a utility. Thus, RGI is currently involved in discussions with a major California utility to sign a power purchase contract, not a contract for the sale of the geothermal resource. RGI's current intent is to sell the geothermal resource to a third party which will construct a utilization facility and that party, in turn, will sell electricity to the California public utility.

Without knowing the criteria that will be established by which, as lessee, RGI might itself be able to document a commitment to construct a utilization facility, the company cannot assert that it would be capable of committing to construct a utilization facility prior to the end of the existing lease term. Furthermore, RGI, as well as most other geothermal companies, is primarily interested in the exploration and the development of geothermal resources, not in the construction of facilities to use those resources.

While we have made substantial investments in the development of these leaseholdings and developed producible wells, under the terms of the currently drafted provisions of section 7, the company would be unable to demonstrate to the Secretary either a commitment to construct the facility or provide evidence of the existence of a bona fide contract to deliver the resource to a utilization facility. As relevant sections of S. 883 are now drafted, unless RGI can meet one of these two tests (commitment to construct or contract to deliver) in addition to having drilled producible wells, the company could not obtain an extension of the lease term.

RGI recognizes that there may be difficult factual questions involved in ascertaining when efforts to make a sale have been delayed by marginal economics or administrative delay. To the extent that the Congress feels it would be difficult to determine what constitutes an effort to obtain a bona fide contract to sell the resource, RGI suggest that the test of substantial investment in development and/or the existence of a producing or producible well on the leasehold should be considered sufficient to indicate the commitment of the lessee. This would be consistent with the treatment to be afforded facility construction delays by section 7(c) of S. 883.

III. Acreage Limitation

Current law limits to 20,480 acres per state the amount of acreage in geothermal leases that may be held by a single party. For many years, the geothermal industry has advocated increasing this acreage limitation to encourage development, and to recognize that the characteristics of the geothermal resource are such that the present limitation is insufficient to enable full development of some resource areas.

Section 8 of S. 883 would increase the acreage limitation to 51,200 acres per state. RGI supports this provision and urges its enactment.

To understand the impacts of a too-low acreage limitation on the development of the geothermal resource, several issues must be examined. First, although the geothermal energy underlying as little as 1,000 acres of land may be technically sufficient to ensure that enough geothermal reserves are available to last the economic life of a commercial-sized geothermal power production facility, utilities considering a commitment to purchase geothermal resources can be expected to require the developer to control many times the geothermal reserves necessary for one power plant. Utilities make this requirement to ensure not only that the reservoir is capable of supplying energy to the power plant for its entire economic life, but also that the reservoir is large enough to make the construction of expensive new electric transmission lines into the area economical. Thus, a geothermal resource developer, in order to develop the resources in the most expeditious manner, needs to control a large portion of the geothermal reserves in any one reservoir. Typically, this will mean controlling from 5,000 to 10,000 acres in any one prospect.

Second, the technology for discovering and quantifying geothermal resources has not been developed to nearly the degree of sophistication now found in oil and gas exploration. Geophysical and geochemical techniques can only generally define those areas which have a potential for geothermal resources and which should, therefore, be leased. These areas, typically ranging from 20,000 to 30,000 acres in size, must be controlled by the geothermal resource developer in order to ensure that the core of the geothermal reserves is eventually found to lie within the area.

After leasing, the drilling of temperature gradient holes and deep resource wells will eventually narrow down the geothermal prospect from 30,000 acres of potential geothermal resources to 5,000 to 10,000 acres of actual geothermal reservoir and geothermal reserves. However, the drilling of terperature gradient holes and deep resource wells may take from two to five years to complete after the lease term begins. For each geothermal prospect on which a well capable of commercial production is drilled, as many as five prospects will likely have been drilled which did not produce geothermal resources in commercial quantities.

The current acreage limitation of 20,480 acres per state allows a geothermal developer only one major prospect per state. An acreage limitation of 51,200 acres as proposed in S. 883 would allow a geothermal developer approximately two major prospects per state. Increasing the acreage limitation above the current level will enable the limited number of companies that are technically and financially able to explore and develop geothermal resources to do so in an orderly and continuous fashion, and may even encourage additional companies to enter the field.

There are several other aspects of the acreage limitation question that should be noted. Because those few companies that are technically and financially able to explore and develop geothermal resources are currently at their acreage limitation in most states, increasing the size of the acreage limitation will also likely increase the number of issued leases and thus increase the size and rate of revenue intake for the federal government through the collection of rentals and royalties. It will certainly increase revenues for local governments since once a lease is issued that property is subject to local taxes.

Increasing the geothermal lease acreage limit will also stimulate geothermal exploration and help identify those areas where geothermal resources, although not suitable for the production of electrical energy, may be applicable for direct heat applications such as space heating and food or industrial processing.

The Geothermal Steam Act of 1970 contains certain due diligence requirements which, over the life of a lease, adequately control speculation and insure that leased lands are explored and developed and not simply held for speculation. Therefore, increasing the acreage limitation should not lead to increased speculation in geothermal leases. It should also be noted that the acreage increase in and of itself will not alter the ability of certain groups to engage in speculation by controlling large numbers of geothermal leases. This type of speculation is possible for a limited period no matter what the size of the acreage limitation.

IV. Definition of Known Geothermal Resource Area

Two other issues addressed in S. 883 deserve brief mention here. S. 833 would redefine the term Known Geothermal Resource Area (KGRA) in several positive respects. Designation of an area as a KGRA would be based on a finding of substantial physical evidence that there are geothermal resources in the area sufficient to support a belief that the prospects of generating electricity in commercial quantities warrant substantial expenditures. This definition in essence eliminates the prior "competitive interest" test, which has in the past produced the creation of many relatively isolated KGRAs. The result of this isolation has been that when these KGRAs are offered for sale, few if any bids have been forthcoming.

Coupled with the definitional provisions in section 3 are provisions in section 5 that would limit the number of leases offered by competitive bidding by automatically declassifying those KGRA lands on which no bids are received. Those lands would then be made available to the first qualified applicant, on a noncompetitive basis.

Taken together, the changes discussed above may decrease the number of competitive leases eventually issued, thereby resulting in a potential loss of bonus bid revenues. However, the federal treasury will ultimately be more than compensated by the timely accumulation of rents and royalties to be delivered from noncompetitive leases which would be issued in those instances where these same leases could not be sold on a competitive basis. RGI strongly supports these proposed revisions.

In addition, present law includes the inequity of allowing the rejection of a noncompetitive lease applicatiom on the basis of the lands being designated as a KGRA long after (in one recent case nearly seven years after) the filing of the application. Section 5 corrects this by granting the noncompetitive lease to the applicant if the lands are not designated as a KGRA within one year of the application being filed. Further, section 5 grants the lease applicant the right to match the highest competitive bid for the parcel or the right to the lease itself if the applicant was responsible for the exploration which resulted in the designation of the lands as a KGRA.

The possibility of lands being designated a KGRA, thereby invalidating previously filed noncompetitive lease applications, has been a major impediment to prudent operators undertaking exploration operations on or near lands upon which they have unprocessed lease applications. The provisions of section 5 in this area are very important.

V. Conclusion

S. 883, especially with the suggested modifications to the availability of the authority to grant extensions to the primary lease term, is a welcome and needed set of amendments to the Geothermal Steam Act of 1970. Although enacted some twelve years ago, the success of the 1970 Act has still to be evidenced; except for the Geysers resource in California, there is still no widespread use of our vast, domestic geothermal resource base. Republic Geothermal believes that the changes called for by S. 883 — if modified to equalize the treatment of lessees with regard to the extension of the primary lease term as suggested here — can assist our infant industry in more rapidly developing this indigenous energy resource.

If a comprehensive legislative package of amendments is not considered this year, RGI urges that the Congress at a minimum address the need for extension of the primary lease term, both for lessees that will construct utilization facilities and for lessees that will ultimately sell the geothermal resource. Similarly, action is needed now to increase the present per state acreage limit to 51,200 acres, as provided in S. 883. These two changes will go a long way in removing the regulatory impediments that exist today to the development of our national geothermal resources.

Attachment

Amend subsection (c) of section 7 to read as follows:

"Sec. 6(a) Geothermal leases shall be for a primary term of ten years. If geothermal resources are produced or utilized in commercial quantities within this term, or any administrative extension thereof as provided in subsections (b) or (c), such lease shall continue for so long thereafter as geothermal resources are produced or utilized in commercial quantities. For the purpose of this subsection, the term "produced or utilized in commercial quantities" includes the completion of one or more producing or producible wells and either (i) a bona fide sale for delivery of geothermal resources to a facility or facilities installed or to be installed not later than five years after the expiration date of the primary term or any administrative extension of such term or (ii) in the case of utilization by the lessee, proof of commitment to construct such facility or facilities at the expiration date of the primary term or any administrative extension of such term and construction of such facility or facilities not later than five years thereafter."

(b) Section 6(b) of such Act (relating to extension of lease term) is amended to read as follows:

"(b) In the event (1) a bona fide sale for delivery of geothermal resources to a facility or facilities installed or to be installed or construction of a facility or facilities by the lessee has not been possible prior to the expiration of the primary term of the lease or any administrative extension thereof as provided in subsection (c) due to administrative delays beyond the control of the lessee or due to demonstrated marginal economics of such a facility or facilities and (2) substantial investment in development of the lease has been made, the Secretary shall, upon petition by the lessee, grant extensions totalling not more than 15 years beyond the expiration date of the primary term of the lease. Where such extension is granted the lessee shall submit annual reports detailing bona fide efforts (i) to resolve the administrative delays, (ii) to consummate such bona fide sale, or (iii) to bring the facility or facilities into economic production."

(c) Section 6(c) of such Act (relating to extension of lease term) is amended to read as follows:

"(c) Any lease for land on which, or for which under an approved cooperative or unit plan of development or operation, actual drilling operations are commenced prior to the end of its primary term and are being diligently prosecuted at the time shall be extended for five years and so long thereafter as geothermal resources are produced or utilized in commercial quantities."

(d) Section 6(d) of such Act (relating to definition of "production or utilization") is deleted and sections 6(e) and 6(f) are redesignated as section 6(d) and 6(e), respectively.

WILLIAM E. NORK, Inc.

CONSULTING SERVICES IN HYDROLOGY AND GEOLOGY

1026 W. First Street • Reno, Nevada 89503

Phone (702) 322-2604

April 18, 1984

The Honorable Chic Hecht
United States Senate
SH-302 Hart Senate Office Building
Washington, D.C. 20510

RE: "GEOTHERMAL ENERGY DEVELOPMENT IN NEVADA'S GREAT BASIN"

Dear Senator Hecht:

I attended your Subcommittee on Energy and Mineral Resources field hearing in Sparks, Nevada on April 17, 1984, but was not among your list of witnesses. Taking advantage of your offer to submit written tetimony for the record, I will greatly appreciate it if you would include this letter.

The thrust of the meeting. it seems to me, was to elicit assistance from you and your committee via new legislation, and modification to existing legislation, such as the Geothermal Steam Act, in order to enhance the development of geothermal resources in our state. This came as no surprise since nearly all of the witnesses represented geothermal development firms. Such enhancement rests favorably with me, to some degree, since I am a part-owner and officer of a geothermal utility company, Sierra Geothermal, Inc., located in Reno, Nevada.

I am, however, first and foremost, a hydrologist. I own and operate a well-established firm in Reno, offering consulting services in hydrology and geology. A considerable part of our work deals with geothermal development, but the vast majority of our work involves development of fresh ground water resources for domestic, industrial, agricultural, and mining uses. As a hydrologist, two bothersome issues become apparent to me from the testimony offered at the hearing.

1. It is difficult to reconcile regulations, such as the Geothermal Steam Act, with the Prior Appropriation Doctrine which governs the ownership, manner and place of use and management of waters in Nevada, and in virtually all of the western states.

   I know of no provision, under the Prior Appropriation Doctrine, that will accommodate royalties to the government, temporary leasing, or depletion allowances. Such provisions appear to be completely inconsistent with the Doctrine.

But, even assuming it is reasonable to remove geothermal resources from the realm of water resources and instead consider it to be an energy resource, much like coal, natural gas, and petroleum, another issue is raised.

2. If, as per the pending Senate Bill, geothermal resources will include all waters whose temperature exceeds 40 degrees Centigrade, these water supplies will be removed from use by the public as a water resource. Such removal is unacceptable for two principal reasons:

   a. Use of geothermal waters may have a significant effect on senior appropriated fresh water rights in the same basin, and if such effect is detrimental, their use must be curtailed under the Doctrine. If these resources are not controled by the Doctrine, this mitigating measure is unavailable to the State and public and is contrary to Nevada Revised Statute 534.110(6).

   b. Present technological advances permits treatment of waters of all types to render it useful for all purposes, in particular, for domestic uses. In other words, man can now render water useful better and faster than he can contaminate it. It is true that such treatment methods are very expensive, in some cases, but in arid regions, such as Nevada, where water is scarce, the availability of palatable and potable waters must have a higher preferred usage than generation of electricity, aquaculture, hydroponics, space-heating, or any of the geothermal energy uses. When waters become so scarce for human use, no cost may be too great.

   You may recall that Sheldon Gordon noted that the space heating geothermal water developed for the Elko Heat Company meets both Federal and State Drinking Water Standards even before the heat energy is extracted. If these waters are to be classified as an energy resource they will be removed from public use as a fresh water supply.

It is possible, I suppose, to regard and classify geothermal waters as both an energy and water resource. To do so, however, will place an unreasonable administrative burden on two separate agencies and promote impractical competition between the agencies. In Nevada, the Department of Minerals and the Department of Natural Resources - Division of Water Resouces would have to compete for control of the resource, and together they would compete with Federal agencies. I believe such competition is totally irrational.

Although Nevada is blessed with an abundance of high and low temperature geothermal resources, I urge you, Senator Hecht, to consider carefully any legislation that will promote the exploitation of these resources at the expense of our limited water supplies.

As noted above,I will appreciate the inclusion of this letter in the hearing record, whether it be in toto or abstracted. I will appreciate also your personal comments on the issues I have raised.

Thank you very much for this opportunity to express my thoughts.

Very truly yours,

WILLIAM E. NORK, INC.

William E Nork

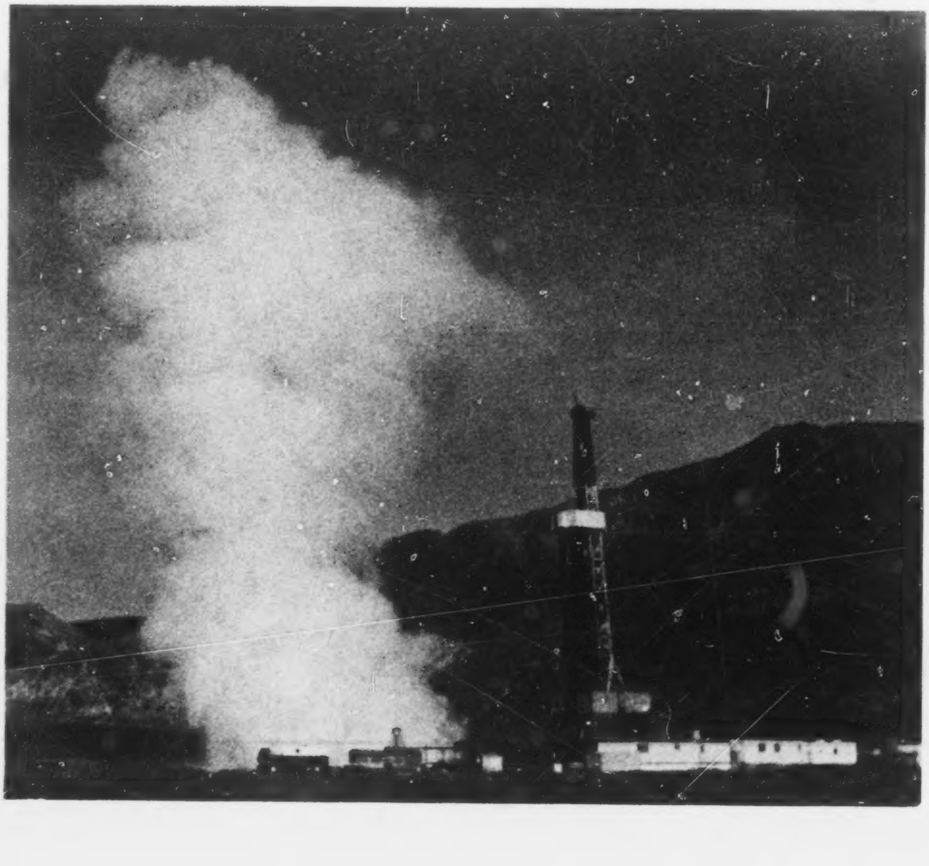
William E. Nork

cc: Peter G. Morros

WILLIAM E. NORK, Inc.
Reno, Nevada 89503

Geothermal Energy

SUN



GEOTHERMAL ENERGY

SUNOCO ENERGY DEVELOPMENT CO.
12700 Park Central Place, Suite 1500
Dallas, Texas 75251
(214) 385-5000

August, 1983

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GEOTHERMAL ENERGY

EXECUTIVE SUMMARY

This paper provides a background statement on geothermal energy as well as a current status report on the potential of this energy source with particular emphasis on the prospects for this resource in Nevada. Although still a relatively new contributor to the United States' energy mix, geothermal electric generation is moving quickly out of its infancy and into what might best be described as promising adolescence.

California currently has 1,122 megawatts (MW) of electrical generation on line from the dry steam fields of the Geysers. Generation from that field alone is projected to more than double within ten years. By the year 2000 the total projected geothermal generating capacity for the entire United States is expected to be between 6,000 and 9,500 MW.

Nevada's share of this significant, renewable energy source is projected to be sizable. Sufficiently large, experts believe, to provide generating capacity well in excess of the State's projected needs by the end of this century. SUNEDCO's Dixie Valley prospect alone has the potential to produce 200-300 MW of power, the equivalent of the Valmy 1 coal-fired power plant owned by Sierra Pacific Power Company and Idaho Power Company. Significantly, Dixie Valley is but one of six major geothermal areas being actively explored within Nevada.

Without question, there is a strong near-term market for geothermal power in and near Nevada. Within this decade California will need over 10,000 MW of capacity, and Nevada's power needs are projected to increase 1,500 to 3,500 MW by the end of the century. Thus, a market exists for economic geothermal energy beginning in the mid-to-late 1980's. Properly planned and economically developed, the projected geothermal energy resource of Nevada has the potential to make a significant contribution to the electrical generating needs of Nevada as well as California over the next twenty years.

With in-state geothermal generating plants, Nevada's benefits are manifold. First, no costly out-of-state fuels need be imported. Moreover, where federal leases are involved, the state stands to benefit by sharing half of the federal royalties paid on the resource by the producers. Second, new plants mean new Nevada jobs and new tax bases for the state. Most important is the assurance of a long-term, clean, renewable energy source within Nevada which can provide for the state's power needs and generate revenues through interstate sales of excess power.

Reaching this potential, however, is not without impediments. The analogy to an era of adolescence in the geothermal industry is apt. On the verge of major growth into a fully-developed and mature industry, there are problems and adjustments which must be resolved.

Major transmission lines must be constructed to market areas within Nevada as well as outside the state, and capacity must be allocated for geothermal power producers. Currently, only limited transmission line and intertie feasibility studies are underway.

Nevada's geothermal resources are different from those in the California Geysers area, which are dry steam reserves. In Nevada the resources are characterized as liquid-dominated, or "hot water", reserves. Converting this hot water resource into electricity is presently an emerging technology with an initial 30 MW of production in the Imperial Valley of California. Various generating technologies need commercial demonstration to develop the full potential of Nevada's resource.

Thus, Nevada's hot water geothermal resources have to be demonstrated and proven before producers can determine the viability of the resource and before utilities will construct transmission lines. These limited-scale demonstration plants would serve to perfect the generation technologies suitable for Nevada's hot water resources. But, based on utilities' current cost of generating electricity and producers' geothermal project cost estimations, producers must receive some form of subsidy in order to demonstrate the resource. If the resources are proven viable, Nevada ratepayers will gain the benefit of a clean, renewable, cost-competitive resource for power generation, totally contained within Nevada.

GEOTHERMAL ENERGY

What Is Geothermal Energy?

Geothermal energy can be defined as the natural heat in the earth that is captured in fluids trapped close enough to the surface to be removed economically.[1] There are three major types of geothermal energy systems: hydrothermal, hot dry rock and geopressured. Site-specific variables, such as depths, temperatures and fluid characteristics greatly affect the economics. In order to have economic potential, the heat must be concentrated in restricted volumes (as is the case for hydrocarbons). Current limitations in extraction technology, along with economics, make the hot dry rock and geopressured systems unfeasible, and only the hydrothermal systems have proven to be practical.

Hydrothermal systems consist of either liquid-dominated (high-temperature water/brine) or vapor-dominated (steam) resources stored in porous or permeable reservoir rocks. In order for the resource's energy to be harnessed, the fluids must be produced and utilized in turbines to generate electricity or used directly for process heat. The production of the geothermal fluids is comparable to the production of oil or gas whereby the reservoir is tapped via a well through which the fluids flow to the surface. Depending on the temperature and relative percentage of steam and water, one of four primary generating plant types (dry steam, flash, binary, combined binary/flash) can be used to produce electricity. Figure 1 illustrates how a hydrothermal system "works" using two plant types, binary and flash, to produce the resource.

Where Is It Located?

Throughout the world, geothermal energy is an important contributor for the generation of electricity. Dry steam geothermal fields began producing in Italy during the early 1900's. Currently, more than fifteen countries have geothermal production, with a generation capacity of 2,781 million watts (MW). Over 1,100 MW of dry steam geothermal production capacity is available in the Geysers area in California. Hot water geothermal plants, producing over 30 MW, are located in the Imperial Valley in California. The projected[2] capacity for the United States is 6,000 to 9,500 MW by the year 2000. Worldwide, the capacity is projected[3] to be over 15,000 MW in the year 2000.

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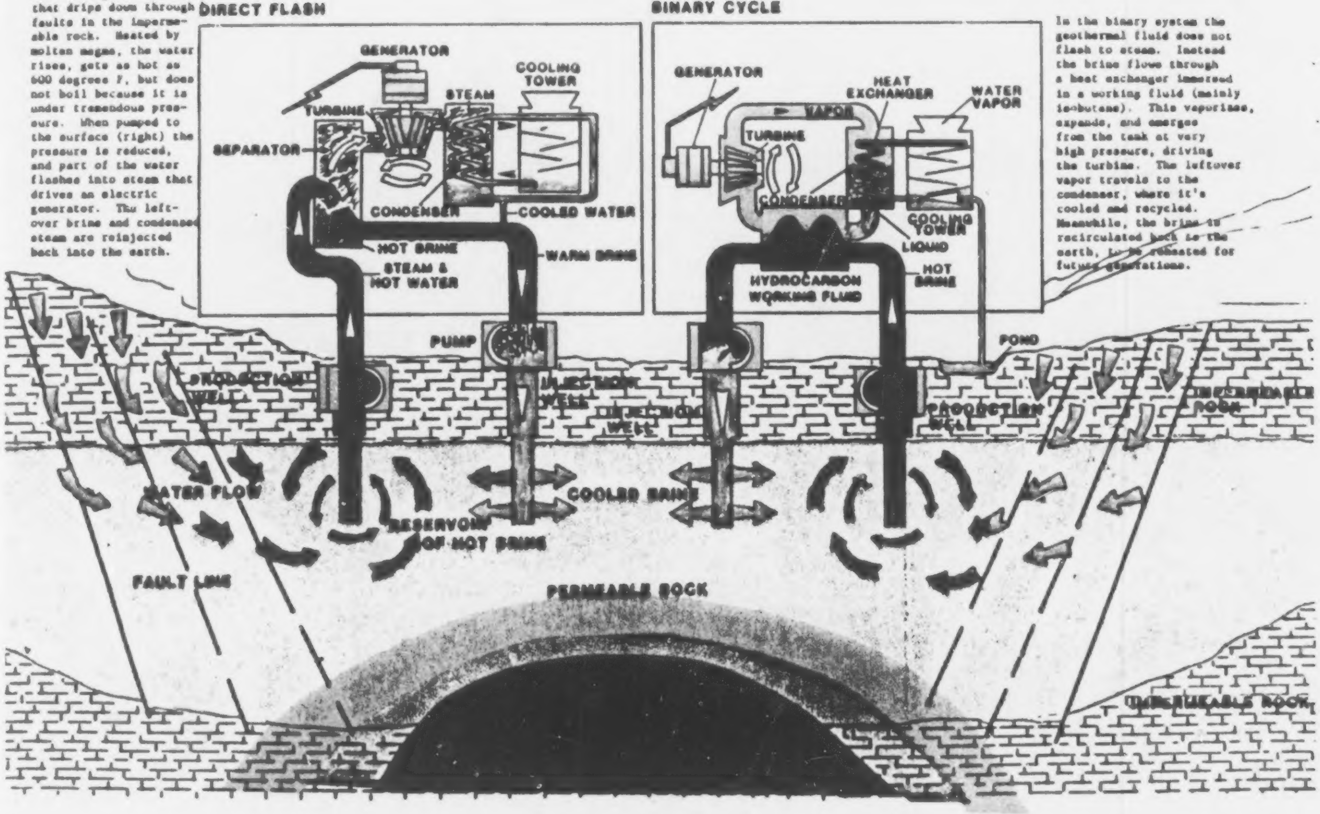
[1] Leibowitz, L.P., 1978, California Geothermal Resources Potential Energy Sources, 3(314):293-311

[2] Projections made by the United States Department of Energy (1982) and the Electric Power Research Institute (1982)

[3] United Nations 1981 Conference on New and Renewable Sources of Energy, Nariobi



Energy from the earth starts as ground water that drips down through faults in the impermeable rock. Heated by molten magma, the water rises, gets as hot as 600 degrees F, but does not boil because it is under tremendous pressure. When pumped to the surface (right) the pressure is reduced, and part of the water flashes into steam that drives an electric generator. The leftover brine and condensed steam are reinjected back into the earth.

In the binary system the geothermal fluid does not flash to steam. Instead the brine flows through a heat exchanger immersed in a working fluid (mainly isobutane). This vaporizes, expands, and emerges from the tank at very high pressure, driving the turbine. The leftover vapor travels to the condenser, where it's cooled and recycled. Meanwhile, the brine is recirculated back to the earth, to be reheated for future generations.

DIRECT FLASH
GENERATOR
TURBINE
SEPARATOR
STEAM
COOLING TOWER
CONDENSER
COOLED WATER
HOT BRINE
STEAM & HOT WATER
WARM BRINE
PUMP
PRODUCTION WELL
INJECTION WELL
WATER FLOW
RESERVOIR OF HOT BRINE
COOLED BRINE
FAULT LINE
PERMEABLE ROCK
BINARY CYCLE
GENERATOR
VAPOR
TURBINE
HEAT EXCHANGER
WATER VAPOR
CONDENSER
COOLING TOWER
LIQUID
HOT BRINE
HYDROCARBON WORKING FLUID
POND
INJECTION WELL
PRODUCTION WELL
IMPERMEABLE ROCK
IMPERMEABLE ROCK

FIGURE 1

Hydrothermal systems are usually found near geologically active areas. Some of these areas form a belt which has been called the "Ring of Fire". This belt extends along the West Coast of South America, North America and Alaska, and around the western Pacific Ocean through the Kamchatka Peninsula, Japan and the Philippines to Indonesia, and along southern Asia into southern Europe.

In Nevada, as elsewhere in the world, the geothermal resources are primarily associated with seismically active areas. Geologically, Nevada is located in the Basin and Range physiographic province which is characterized by an abnormally high heat flow resulting from thinning of the earth's crust. Linear north-south trending ridges and valleys separated by a series of faults are associated with the Basin and Range province. Groundwater is circulated along the faults to considerable depth and is heated by the hotter subsurface rock.

Nevada's numerous hot springs, with water near the boiling point, are related to this deep subsurface groundwater circulation. Hot springs and wells are scattered over the entire state, with at least 300 thermal wells known in Nevada. Most of Nevada's hot springs are found in the northern part of the state. The principal geothermal resource areas, hot springs and wells are shown on Figure 2.

Nevada ranks second to California in total geothermal exploration activity. Although Nevada's potential geothermal resources have been estimated at over 85,000 megawatt years,[4] additional exploration work will be needed to delineate known resource area boundaries and to identify and confirm potential resource areas. The locations of major geothermal resources currently slated for development are depicted in Figure 3.

Chevron's Beowawe geothermal resource, Phillips' Desert Peak and Steamboat Springs resources and Sunedco's Dixie Valley resource are all located in the northern portion of Nevada.

Sunedco's Dixie Valley Geothermal Resource

Sunedco's Dixie Valley geothermal resource site is located in Churchill County, approximately 100 air miles east of Reno. Sunedco began acquiring property in the area in 1975 and currently holds about 8,000 acres under four federal and two fee leases.

Dixie Valley is typical of faulted valleys in the Basin and Range province. Normal faults, active since mid-Cenozoic time,

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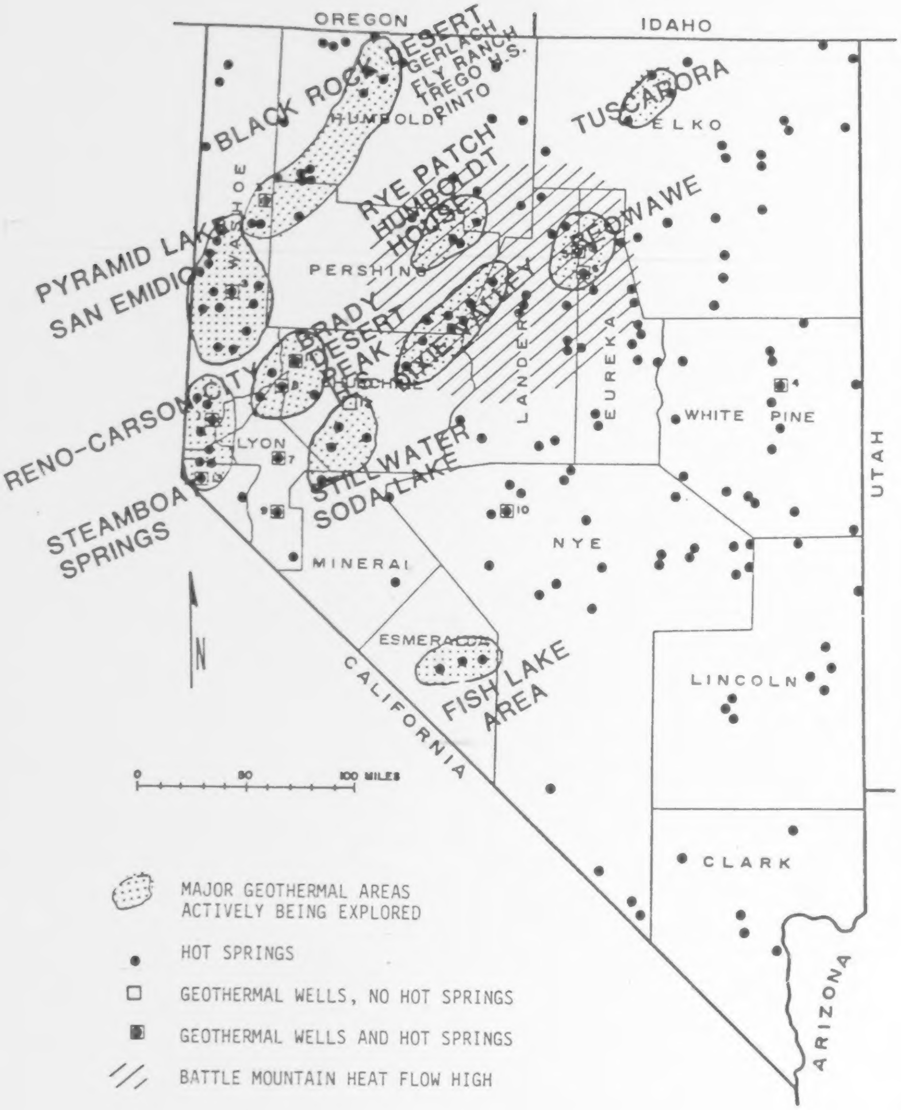
[4] Geological Survey Circular 790, "Assessment of Geothermal Resources of the United States - 1978," L. J. P. Muffler, Editor, 1979, pp. 50-55


OREGON
IDAHO
BLACK ROCK DESERT
GERLACH
FLY RANCH
TREGO H.S.
PINTO
HUMBOLDT
TUSCARORA
ELKO
WASHOE
RYE PATCH
HUMBOLDT HOUSE
BEOWAWE
PYRAMID LAKE
SAN EMIDIO
PERSHING
BRADY
DESERT PEAK
DIXIE VALLEY
LANDER
EUREKA
RENO-CARSON CITY
CHURCHILL
LYON
WHITE PINE
4
UTAH
STILLWATER
SODA LAKE
7
9
10
STEAMBOAT SPRINGS
NYE
MINERAL
N
ESMERALDA
CALIFORNIA
FISH LAKE AREA
LINCOLN
0
50
100 MILES
CLARK
ARIZONA
MAJOR GEOTHERMAL AREAS ACTIVELY BEING EXPLORED
HOT SPRINGS
GEOTHERMAL WELLS, NO HOT SPRINGS
GEOTHERMAL WELLS AND HOT SPRINGS
BATTLE MOUNTAIN HEAT FLOW HIGH

NEVADA GEOTHERMAL AREAS

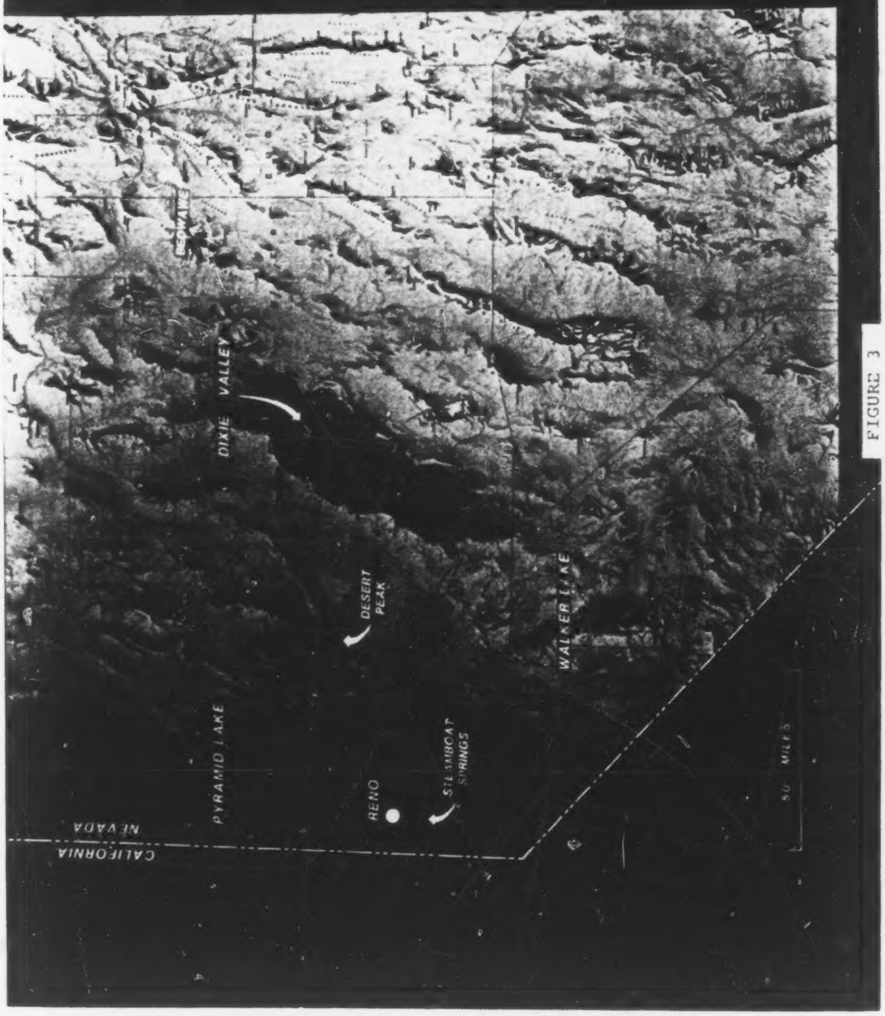

BEOWAWE
DIXIE VALLEY
DESERT PEAK
WALKER LAKE
PYRAMID LAKE
RENO
STEAMBOAT SPRINGS
50 MILES
NEVADA
CALIFORNIA

FIGURE 3

have dropped the valley floor thousands of feet relative to the enclosing mountain ranges. Alluvial gravels and fine-grained lacustrine sediments have accumulated to great thickness within the graben. The surrounding mountain ranges are made up primarily of deformed Mesozoic sedimentary and igneous rocks capped by a substantial thickness of Tertiary volcanic flows and sediments.

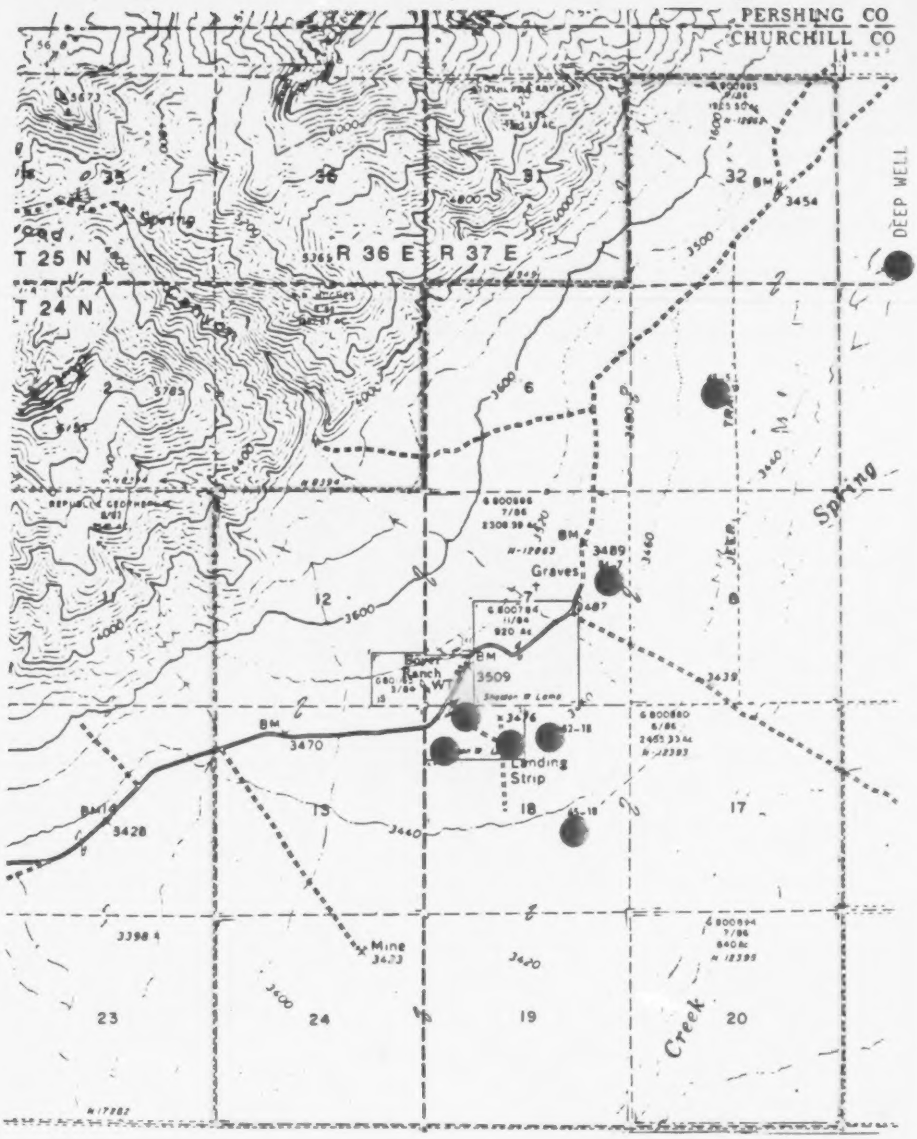
Included in the geothermal regime of Dixie Valley are hot springs, fumaroles and areas of intense hydrothermal alteration.

Sunedco has conducted several heat flow drilling programs, consisting of shallow holes drilled to depths ranging from 30' to 1,500'. From this exploratory work, Sunedco mapped a large heat flow anomaly extending along the eastern margin of the Stillwater Mountain Range in which temperature gradients are consistently greater than 100°C/Km (5.5°F/100'). The presence of the heat flow anomaly is further supported by various geophysical anomalies which tend to overlap each other in the same vicinity.

The resource discovery well was drilled in 1978, and six additional wells have been subsequently completed. Figure 4 maps the Dixie Valley prospect with the well sites shown in red circles. Geothermal production is from fractured/faulted zones of permeability in a volcanic section which is physically competent enough to develop and maintain a discrete fracture system. These rocks are intermediate to basic lavas. Independent of fault planes, the volcanic rocks tend to be naturally permeable in part. The additional permeability of the volcanics was caused by initial cooling which created fractures and rubble zones along the upper and lower flow boundaries.

Fractures occur either naturally or in association with faulting. Within the permeable cavities of the fractures, numerous hydrothermal minerals are evident in the cuttings. The ultimate areal extent of the producing reservoir is believed to conform closely to the mapped heat flow anomaly. This represents an area of favorable fault/fracture permeability having reservoir temperatures in excess of 400°F. The depth of the producing reservoir ranges between 6,000 to 10,000 feet below ground surface. Figure 5 graphically interprets the geology of Dixie Valley.

From Sunedco's geological and geophysical surveys and information gained from deep drilling, Sunedco believes that the hydrothermal heat source for the reservoir fluids is active deep water circulation within a convective heat cell system.


PERSHING CO
CHURCHILL CO
DEEP WELL
T 25 N
T 24 N
R 36 E
R 37 E
35
36
31
32
BM
3454
3500
Spring
Canyon
6000
5365
3600
6
2
1
12
7
8
13
18
17
23
24
19
20
Graves
3489
BM
3509
Boyer Ranch
3476
Landing Strip
BM
3470
3428
3440
3439
Spring
Creek
Mine
3423
3398
3420
REPUBLIC GEOTHERMAL

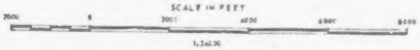

SCALE IN FEET
2000
0
2000
4000
6000
8000
1:24000

FIGURE 4

SUNEDCO

PARK CENTRAL PLACE
DALLAS TEXAS

DIXIE VALLEY PROSPECT

PERMIT No.		LEASE No.	
COUNTY	CHURCHILL	STATE	NEVADA
LOCATION			
DESIGNED BY			
GEOLOGY BY		CONTOUR INTERVAL	
DRAWN BY		CHECKED BY	DATE

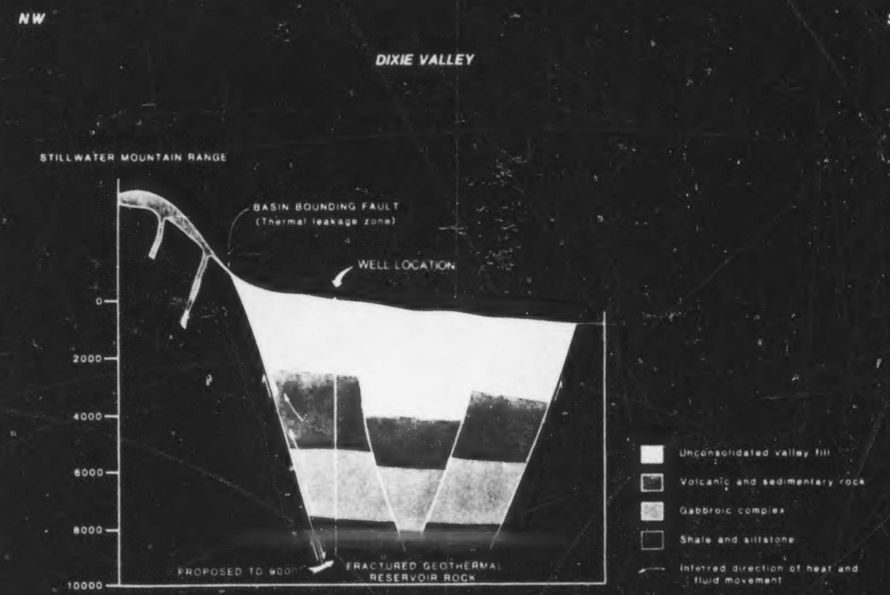

NW
SE
DIXIE VALLEY
STILLWATER MOUNTAIN RANGE
BASIN BOUNDING FAULT
(Thermal leakage zone)
WELL LOCATION
0
2000
4000
6000
8000
10000
PROPOSED TD 9000'
FRACTURED GEOTHERMAL
RESERVOIR ROCK
Unconsolidated valley fill
Volcanic and sedimentary rock
Gabbroic complex
Shale and siltstone
Inferred direction of heat and fluid movement
-8-

FIGURE 5

The hydrological recharge system is believed to be groundwater movement from the mountain ranges toward the valley, with groundwaters descending deep into the earth, being heated, and convecting upward. Additional evidence suggests major deep underflows from the northeast and southwest, converging in the deepest portion of the basin in the vicinity of the present producing area. Such a hydrological system as described would have enormous impact on the producing life of the reservoir, because Dixie Valley and the six adjoining valleys which drain into Dixie Valley make up a closed hydrologic system approximately 100 miles long and 10 to 20 miles wide with a total drainage area of 2,350 square miles.

Testing for extended periods has shown that the seven Sunedco wells are capable of fueling a 10-16 MW demonstration plant. Engineering, geological and geophysical studies infer the resource could potentially produce 200-300 MW of power. This is equivalent to the amount of power generated at the Valmy 1 or Valmy 2 coal plants, owned by Sierra Pacific Power Company (SPPC) and Idaho Power Company (IPC).

The Dixie Valley reservoir fluid contains sufficient heat to generate electricity, but a demonstration project is necessary to effectively evaluate the reservoir potential and to optimize available generating technology in order to maximize the efficient use of the resource. Dixie Valley is similar in nature to geothermal resources in the Imperial Valley, California, except that the well effluent is much lower in solids content.

Market for Nevada's Electrical Generation

In addition to meeting Nevada's load demand, Nevada utilities market electricity to California utilities and to a much lesser degree to Arizona utilities. Excess power from Valmy 1 and 2, owned by SPPC and IPC, will be sold to California utilities. Also, within the State of Nevada are sited six coal-powered plants owned in part by California utilities and operated by Nevada Power Company (NPC): the Mohave Station, two 750 MW plants and Reid Gardner Station, four 250 MW plants. In the planning/permitting stages are eight other coal plants partially owned by California utilities: White Pine (NPC), two 750 MW plants scheduled for operation in 1989 and 1990; Harry Allen (NPC), three 500 MW plants scheduled for the mid-90's; and Thousand Springs (SPPC), three 500 MW plants scheduled for the mid-90's. Currently, fuel for the operating coal plants is obtained from Utah and Arizona. Tentatively, future fuel purchases for existing and planned coal plants will be comprised of Utah, Arizona and Wyoming coal, although New Mexico and Colorado coal could possibly be utilized. The following table lists the plants, capacities and ownership.

COAL POWER PLANTS SITED IN NEVADA

NAME		CAPACITY MW	OWNERSHIP %		YEAR OF OPERATION
Reid Gardner	1	250	32.2	NPC	1965
	2	250	*67.0	LADWP	
	3	250			
	4	250			1983
Mohave	1	750	14.0	NPC	1971
	2	750	*56.0	SCE	
			*20.0	LADWP	
			20.0	SRP	
Harry Allen	1	500	24.0	NPC	Mid-'90s
	2	500	*20.0	SMUD	
	3	500	8.0	UTAH	
			*48.0	CA	
Valmy	1	250	50.0	SPPC	1982
	2	250	50.0	IPC	1985
White Pine	1	750	25.0	NPC	1989
	2	750	10.0	SPPC	1990
			*39.0	LADWP	
			*17.0	CA	
			9.0	NEVADA	
Thousand Springs	1	500	20.0	SPPC	Mid-'90s
	2	500	*80.0	OR,CA,ID	
	3	500			

*Ca. Utilities:
Los Angeles Dept. of Water & Power (LADWP)
Southern California Edison (SCE)
Sacramento Municipal Utility District (SMUD)
Small percentages, various Ca. utilities (CA)

Of the seven operating coal generation plants sited in Nevada with a capacity of 2,750 MW, 64 percent of the capacity is owned by California utilities. Six of the planned coal plants for which ownership has been determined have a capacity of 3,250 MW. California's share of the production will be 57 percent. California utilities will also participate in the Thousand Springs, 1,500 MW, project but the extent has not yet been agreed upon.

Power will be transmitted across Nevada from the Intermountain Power Project (IPP) (1986, 1987) which is 58 percent owned by California utilities. The two 750 MW plants are sited in Utah and will utilize Utah coal. The Nevada coal generation plants and IPP plants are illustrated on Figure 6.

Figure 6 also shows load growth rates forecast by utilities in Nevada and surrounding states. Nevada utilities forecast additional generation requirements of 1,500 to 2,500 MW to meet demand until the end of the century. Within the next ten years, over 10,000 MW of additional capacity will be necessary for California utility systems to meet their load growth requirements. California utilities, as those in other western states, plan, for the long term, to (1) maintain their expensive oil and gas generation facilities only for peaking purposes, or (2) convert them to burn coal or (3) replace the units with alternative fuel generation plants.

Current transmission capacity, depicted on Figure 6, limits the amounts of power sold to California utilities by surrounding utilities. Studies are underway to construct power lines connecting major generating areas (interties) to tap the California market.

Nevada's Geothermal Generation Potential

Although electrical generation additions in the western states will reflect primarily coal and nuclear power plants for the next ten years, geothermal power can contribute a substantial portion of the additions for the late 1980's if price competitive. Over 40 percent of California's planned additional capacity is from renewable resources. In Nevada, a resource plan recently adopted by Sierra Pacific Power Company emphasizes the addition of geothermal capacity. However, public utility commissions in Nevada, California and other western states have stated that energy from non-demonstration geothermal plants must not be priced higher than the utility's "avoided cost". "Avoided cost" is defined as the amount the utility has to pay either to generate additional energy or to purchase energy.

Geothermal energy, then, other than demonstration projects, has to be priced at or below avoided cost. In Nevada, hot water geothermal resources have not yet been proven viable, and demonstration projects are needed. If geothermal resources prove feasible after demonstration projects are concluded, the Nevada ratepayer will gain the benefit of a clean renewable resource for proven generation, totally contained within the State of Nevada and at a competitive price.

Geothermal exploration and development will add jobs and increase the state's tax base. In addition, under current regulation, half the royalties for resource production on federal leases will be returned to the state. This cost impact could be equivalent to a 2.5 percent reduction in the cost of power produced on federal land.

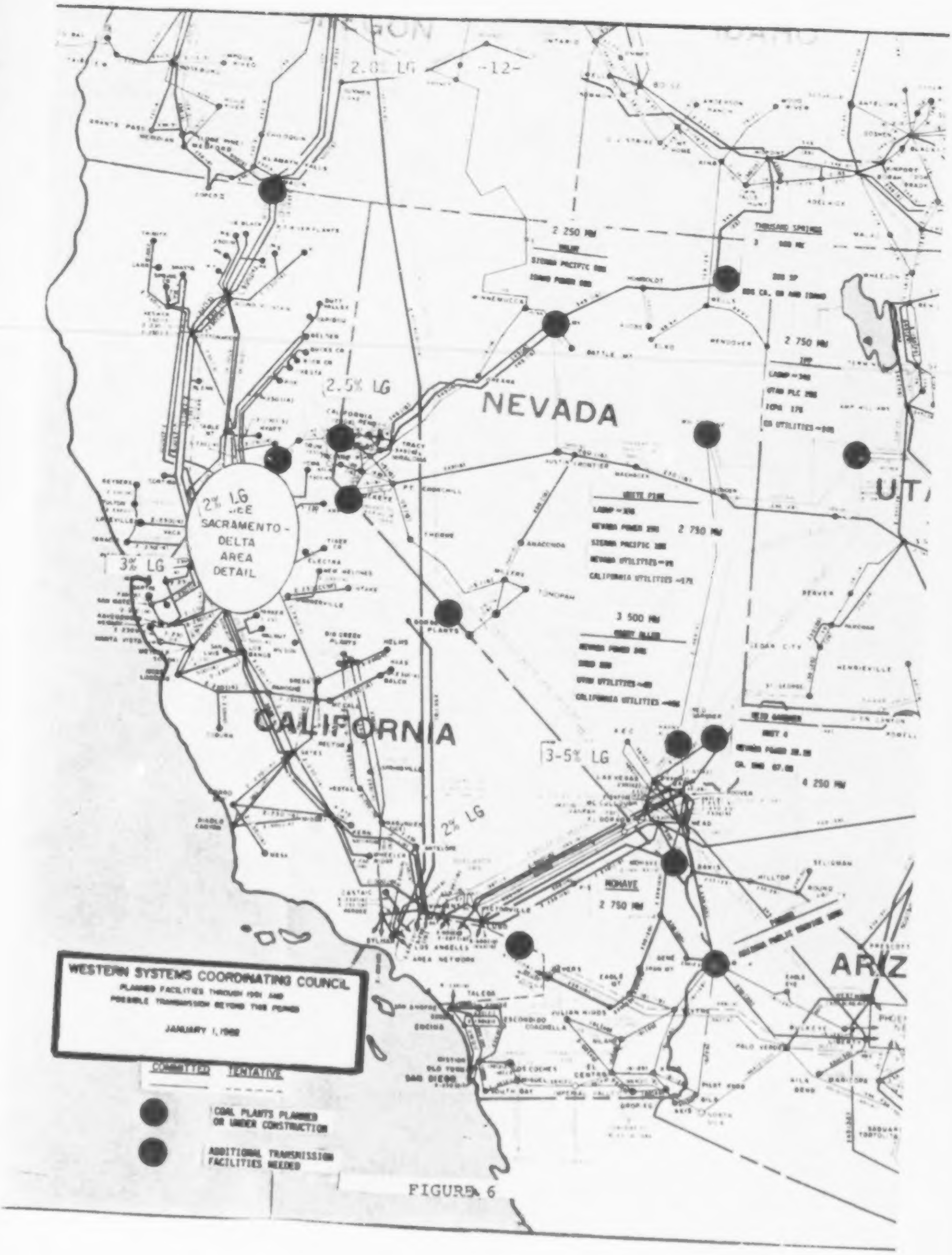

2.0% LG
-12-
2 250 MW
THOUSAND SPRINGS
2 750 MW
2.5% LG
NEVADA
UTA
2% LG
SEE
SACRAMENTO-
DELTA
AREA
DETAIL
3% LG
WHITE PINE
2 750 MW
3 500 MW
CALIFORNIA
3-5% LG
4 250 MW
2% LG
MOHAVE
2 750 MW
ARIZ
LOS ANGELES
AREA NETWORK
SAN DIEGO
WESTERN SYSTEMS COORDINATING COUNCIL
PLANNED FACILITIES THROUGH 1981 AND
POSSIBLE TRANSMISSION BEYOND THIS PERIOD
JANUARY 1, 1982
COMMITTED
TENTATIVE
COAL PLANTS PLANNED OR UNDER CONSTRUCTION
ADDITIONAL TRANSMISSION FACILITIES NEEDED

FIGURE 6

Nevada utilities will also benefit from geothermal energy. Utilities have already begun to recognize the advantages of small power generation for the following reasons. First, stability to the utility's system is increased because dependency is spread among many power plants. Second, there is a reduced need to construct large new facilities to ensure adequate reserve margins. Third, the shorter lead time associated with building small plants allows the utility to quickly recover construction capital and gives the utility greater flexibility in matching energy supply to demand requirements. Also, if large plants continue to be delayed, due to capital constraints or environmental/regulatory problems, small plants can be built to meet demand. For these reasons, utilities in Nevada and California can use geothermal energy to meet their growth requirements during the late 1980's and early 1990's.

Within the next decade, Nevada hot water geothermal power generation can contribute 300-400 MW based on current resource plans of Nevada and northern California utilities. The resource plans for Pacific Gas and Electric (PG&E) contain 150 MW hot water geothermal generation; Sacramento Municipal Utility District (SMUD), 140 MW; and Sierra Pacific Power Company, 50 MW by 1992 and 600 MW by the year 2000. Smaller utilities and cooperatives can also be expected to utilize geothermal plants.

Large amounts of additional generation capacity likely will not be required in the western states until the mid-'90's. Before large geothermal developments can begin, transmission capacity will have to be increased and major transmission facilities and interties will have to be constructed. Although the development of major Nevada geothermal resources before the mid-'90's would require careful planning, geothermal energy development per se is not dependent upon a "window".[5] If geothermal resources are demonstrated now, the projects can be developed in a timely fashion to meet utility demand.

Geothermal Development Status

In 1978, Congress enacted Sections 201 and 210 of the Public Utility Regulatory Policies Act (PURPA) to encourage alternate energy production and cogeneration projects. PURPA requires utilities to purchase power at special rates and terms for cogeneration projects and small power producers who meet certain conditions. Among the conditions specified are that small power production facilities such as geothermal plants must have a capacity not exceeding 80 MW, must not utilize fossil fuel for more than 25 percent of their annual fuel usage, and must not have utility ownership of more than 50 percent.

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[5] A "window" is defined here as the time interval in which a large demand for power exists.

As further inducement and encouragement under PURPA, a supplier can own a power plant and generate electricity (providing the plant is no greater than 80 MW net) without having to become an electric utility.

Utilities are required, under the Federal Energy Regulatory Commission (FERC) regulations (final rules issued February 19, 1980) implementing PURPA 210, to pay rates for purchases that are: (1) just and reasonable to the electric consumer (the ratepayer), (2) in the public interest, and (3) nondiscriminatory against qualifying facilities.

The FERC rules established "just and reasonable rates" as those costs which reflect the utilities' costs avoided by hooking up with a geothermal producer (small power producer/cogeneration project) and defined avoided cost as "incremental costs" (what it would cost the utility to purchase power or generate additional power). This is known as the "full avoided cost rule".

For the Nevada utilities, Sierra Pacific Power Company's current avoided cost is about 5.5¢/kwh and Nevada Power Company's is 4.0¢/kwh. In California, Pacific Gas and Electric's avoided cost is around 7 to 7.5¢/kwh and Southern California Edison's is 6.2¢/kwh.

Price estimates for Nevada demonstration geothermal projects range from 7 to 10.5¢/kwh. This figure is well above the price Nevada utilities are required to pay small producers. In order to demonstrate the resource and prove the reservoir, producers need assistance in the form of a subsidy covering the difference between avoided cost and price. By the time a geothermal resource is discovered, producers have already expended large sums of money on exploration and are reluctant to commit additional exploration and development funds until the resource is demonstrated.

Within Nevada, geothermal exploration actitity is proceeding at a slower pace than a few years ago, but a moderate increase in activity has occurred this summer. Geothermal exploration is underway in the Humboldt River, Soda Lake, Brady Hot Springs, Fish Creek Valley, Steamboat Springs and Smokey Valley areas. In 1982, two discoveries were made from five exploration wells. At least one deep well has been drilled this summer in the Dixie Valley area.

There is currently no geothermal energy production but recent events indicate that Sierra Pacific Power Company has entered into contract negotiations or discussions with three non-resource holders (potential producers) in the Brady Hot Springs, Smokey Valley and Steamboat Springs areas. Also within Nevada, a California group has contracted with the Fallon Naval Air Station for geothermal resource exploration and development.

During the 1983 Nevada legislative session, Assembly Bill 592 was enacted which allows geothermal producers to export the capacity of the project if the service area utility declines to purchase the power. Although this legislative change will enable geothermal power producers to reach a broader marketing area, a deterrent still exists which could possibly stymie Nevada geothermal resource development. This factor is the lack of major transmission interties between Nevada and the California market along with the lack of transmission lines and capacity within Nevada. Currently, limited feasibility studies are underway to determine the viability of producer owned direct transmission lines and also utility intertie lines. If and when these lines are constructed, geothermal resource development can proceed.

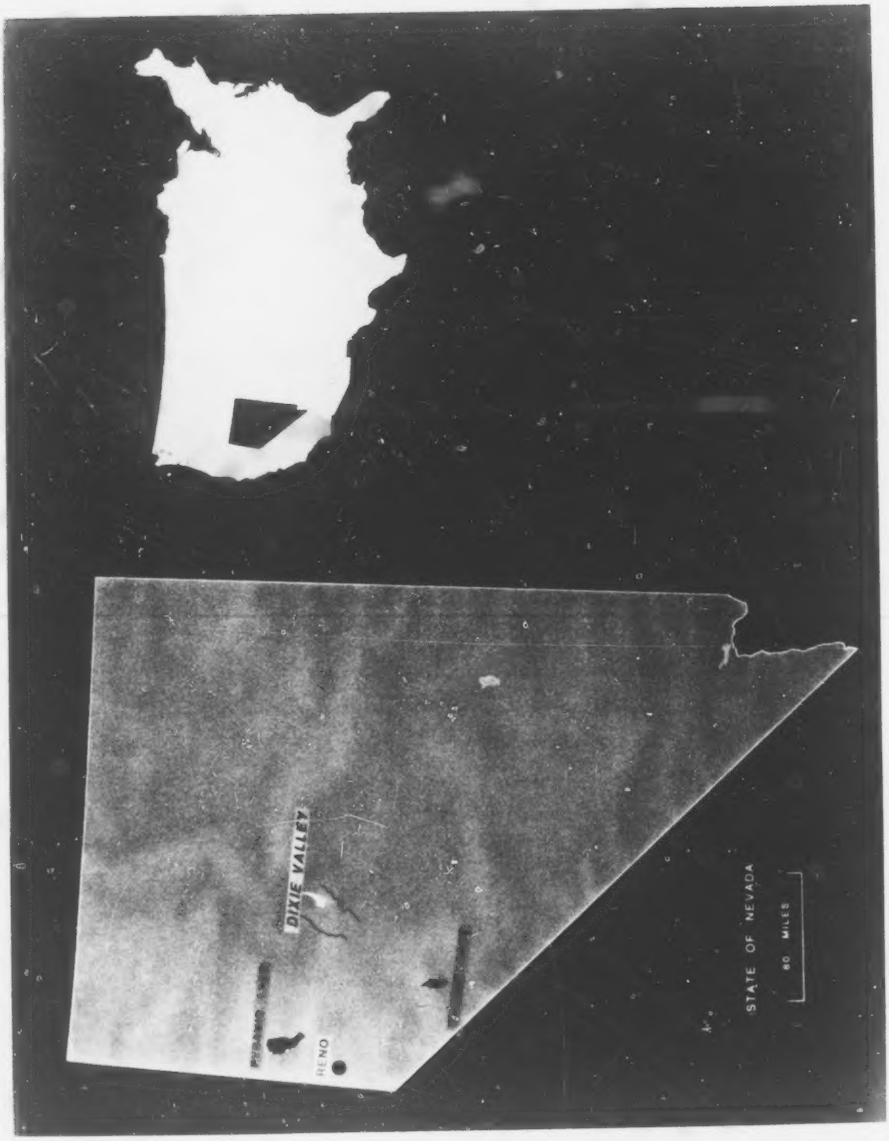
Conclusion

Geothermal energy, a renewable resource, is universally accepted as an environmentally clean power source and as a viable alternative to fossil fuels. California and Nevada utilities are committed to replacing oil and gas generation facilities with renewable resources as well as using "renewables" for additional capacity requirements. Over 10,000 MW of capacity is needed in California within the next decade and 1,500 to 3,500 MW in Nevada by the end of the century. A market already exists for economic Nevada geothermal energy beginning in the mid to late 1980's.

Although Nevada's geothermal energy potential has not been quantified, large-resource indicators -- numerous hot springs, fumaroles and thermal wells -- are present. Other geological and geophysical data indicate the possibility of large geothermal reservoirs. Currently, development is tentatively planned in at least four resource areas.

Resources have to be demonstrated and proven before producers can determine the viability of the resource and before utilities will construct transmission facilities. Based on utilities' current avoided costs and producers' geothermal project cost estimations, producers must receive some form of subsidy in order to demonstrate the resource. Producers have much to lose if their geothermal resources do not prove to be viable. For instance, Sunedco has already invested tens of millions of dollars in Nevada geothermal exploration work.

The exploration, development and production of geothermal energy can contribute substantially to Nevada's economy. Resource development will add jobs and increase the state's tax base. Half the royalties for resource production on federal leases will be returned to the state, and Nevada ratepayers will gain the benefit of a clean, renewable, cost-competitive resource for power generation, totally contained within the State of Nevada.


DIXIE VALLEY
RENO
STATE OF NEVADA
80 MILES

TESTIMONY OF DOMENIC J. FALCONE
BEFORE THE SENATE SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

HONORABLE CHIC HECHT

17 APRIL, 1984

Good Morning.

My name is Domenic J. Falcone. I am Executive Vice President of Geothermal Resources International, Inc. Our chief executive office is Menlo Park, California and we have a field office primarily consisting of technical professionals in Santa Rosa, California. We lease potential geothermal properties in The Geysers, California, Dixie Valley, Nevada and other locations in both of those states as well as in Oregon , Utah and New Mexico.

Our company has been operating in the geothermal business since the 1960's. We were one of the first exploration companies in The Geysers. Since the 1960's, GRI has drilled between 15 and 20 deep test wells. In the last 3-4 years, we have spent in exploration and development activity in excess of $30,000,000. We sell steam to PG & E at The Geysers. GRI is publicly traded on both the American Exchange and the Pacific Exchange. We recently raised approximately $15,000,000 through public offerings.

One of the primary reasons for our increased activities has been the tax treatment for geothermal activities brought about by the 1978 Tax Reform Act. Clarification of treatment for intangible drilling costs, depletion and tax credits was an important ingredient for our ability to raise necessary funds in order to drill wells and proceed toward sale of steam to utilities. These ingredients were necessary because the geothermal business is in its infant state; has very long lead times from discovery of the resources to the time of actual sale, competes with more conventional sources of power production and is very expensive. We requested at the time of testimony for the 1978 Tax Reform Act that the energy tax credit be put on the books for at least 10 years because we knew the lead time requirements of the business. Unfortunately only part of our story was heard and we are now on the brink of seeing energy tax credits terminate at the end of 1985 before a number of projects that could have availed themselves of the credits actually go into service. I am concerned for those projects as well as future projects. We need energy credits for at least another 5 years, say to the end of 1990. Along with the extension of the credits we need clarification that the equipment on which you compute the credit is all equipment related to the geothermal project even though it may not be special type geothermal equipment. It still is necessary equipment to make the geothermal field viable. A good example of the leadtime problem and equipment problem is Dixie Valley, Nevada where it was over 5 years ago that Sun made the initial discovery and there still does not exist a resource sale contract and the operators (steam sellers) are being requested to construct the power plant and transmission line while still not being absolutely confident whether all costs for the plant and line will receive satisfactory tax treatment either because of timing or inadequate description of alternate energy equipment. Without satisfactory tax benefits on these elements, investor monies are going to be hard to raise.

I believe the depletion allowance is satisfactory since it is competitive with other energy sources. By the way, it is conceded by most that geothermal represents a cheaper energy source than gas and oil and certainly is safer than nuclear. With all the government subsidies and utility distortions as to cost of nuclear energy, it is difficult to say whether goethermal is cheaper than nuclear. I believe when all of the facts are known, geothermal will prove to have been so.

A few years ago, the federal government had a good idea to help geothermal developers in raising borrowed money in the financial marketplace. It was the geothermal loan guarantee program.

Unfortunately, it was not very successful because the administrators kept changing the basis for compliance under the program. I believe that the program was intended to accelerate geothermal energy production and with that as a goal it should not have mattered where the activity was taking place as long as it seemed to have a reasonable basis for success. I would like to see this program reactivated but with fewer judgments made by the administrators other than on resource availability and potential market place.

As to market place, I think the PURPA rules should be expanded to allow for more than 80 MW to be sold by one plant owner within a mile of each of his facilities. With plants being built more efficiently, it takes less resource to generate 80 MW and it seems wasteful to have available resource but be unable to sell it without being designated a regulated utility. The PURPA rules were designed in part to allow for sale of alternate energy in order to replace more expensive depleting resources. The rules were also intended to force utilities to switch from conventional more expensive sources to alternate sources of energy. The utilities are still fighting the steam suppliers by using certain parts of the rules to impede or slow down the geothermal operators' activities. Certain utilities would prefer the operators to build and pay for a long transmission line for them, dedicate the transmission line to the utility only and in fact give the line to the utility for its use unless the steam developer is using it completely. This is done under the guise of selling electricity to the utility at its system. Obvious tightening of the PURPA law is required.

Lastly, there seems to be concern over geothermal development in national parks. There is a current piece of proposed legislation which is intended to deal with leased lands from the federal government and a method for restricting activity in national parks. I believe that the section of this legislation which seems to be controversial and is holding up the expansion provision for leasing acreage outside of national parks is already in place and therefore not necessary. Elimination of the fight over the parks and approval of the balance of the legislation allowing for companies to lease more than 20,560 acres in any one state would be most welcome.

The geothermal business will make a significant contribution to the nation's energy needs, but only if it has the support of the governments involved. Geothermal is a domestic energy source and should be treated favorably because of that, if for no other reason. Your help and concern is appreciated.

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